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SIR PHILIP MAGNUS

Industrial Education

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BY

SIR PHILIP MAGNUS

MEMBER OF THE LATE ROYAL COMMISSION ON TECHNICAL INSTRUCTION

AUTHOR OF 'LESSONS IN ELEMENTARY MECHANICS' ETC.

LONDON

KEGAN PAUL, TRENCH, & CO., 1 PATERNOSTER SQUARE

1888

PREFACE.

THE following Chapters contain the subject-matter of Articles and Addresses which have been written and delivered on different occasions during the past six years. Some of them have already appeared in the pages of the 'Contemporary Review' and of other publications. All of them, excepting the 'Inaugural Address at the opening of the Finsbury Technical College,' have been carefully revised and in part rewritten. They are now offered as a contribution to the study of the important problem: How to train our industrial population, so as to best fit them to engage in technical and commercial pursuits.

P. M.

ATHENÆUM CLUB, *October* 25, 1888.

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INDUSTRIAL EDUCATION.

CHAPTER I.

EDUCATION IN RELATION TO THE NEEDS OF LIFE.

THE problem of industrial education is that of adapting education to the practical needs of life. These needs are various, and the term industrial education is employed with reference to the general and special training which is best adapted to that overwhelmingly large proportion of every community who are employed directly or indirectly in the production and distribution of saleable commodities. Such persons may be employed in agriculture, in engineering, in building, or in any other branch of constructive work, such as cabinet-making; in designing; in mercantile or banking business. The question, which of late years has been from different points of view very fully discussed, is, what relation, if any, should subsist between school teaching and the work of life?

It is usual to distinguish between the education that is preliminary to what, for want of a better term,

may be called apprenticeship, and that which is carried on *pari passu* with the learning of a trade, or with specific reference to some industrial occupation. The former is the education given in our ordinary elementary and higher schools; the latter may be called 'professional instruction,' and is obtained in special schools and institutions. When people speak of 'technical education,' they generally mean specialised instruction; but the demand for technical education has made us carefully consider whether the instruction given in our ordinary schools is the best preparation for it. And the consideration of this question suggests a previous one, whether it is necessary or desirable that the concerns of practical life should cast their shadow behind them, and influence the education given in ordinary schools. There are many persons who doubt the necessity of establishing any relation between school education and the practical business of life. They tell us that 'education' is a word derived from *educo*, and means a 'drawing out' of the faculties. It is training and nothing more. In the gymnasium a man does not exercise his muscles with the view to their use in boating, cricket, shooting, boxing, or riding, but for the development of his physical strength, confident that by such exercise he will be able to apply his powers to any purposes for which they may be required. In the same way, it is contended that mental training should consist of the development of

the mental faculties, of observation, memory, and reasoning, and that the knowledge acquired is of secondary importance; and, further, that the instruments employed in the processes of education are as indifferent, or nearly so, as are those used in the gymnasium.

There is much to be said in favour of the view that education is the development of the human faculties, and that its object should be to enable us to observe accurately, to recall easily and vividly, to present to our minds facts and circumstances realised or imagined, and to reason correctly.

If education did no more for us than this it would do much; and, in order that it might do this, many of our present methods of instruction would need to be greatly modified, if not entirely changed. But those who advocate this theory, and act upon it, are not altogether consistent. They avail themselves of it in so far as it helps to defend the common educational practice of studying comparatively useless subjects, but they are constantly making concessions, small and insignificant it is true, to the other theory, that education should develop our faculties with the view of enabling us to discharge the varied duties of life. There are certain studies, commonly pursued in schools, which have long since lost the practical use they at one time possessed; and it is pleaded, in justification of the retention of them, that although not necessarily useful in the sense of being applicable to

the needs of life, they have a high disciplinary value as exercises for the mind, and as a means of developing and training the intellect. This is now the main argument in favour of retaining the study of the classical languages and of Euclid in nearly all our schools.

It is not contended that a knowledge of the classics is likely to be of sufficient advantage to the pupils to justify the hours devoted to the study; or that such knowledge is likely to be of any real use in enabling them to discharge their duties in the various occupations in which they will be subsequently engaged. The establishment of a relation between the teaching of the school and the practical work of life is considered neither necessary nor even desirable by those who regard the end of education as development only. I have said that the advocates of what I may call the 'gymnastic' theory are not consistent The pressure of public opinion prevents them from being so. If we look through the subjects of instruction in any one of our schools we shall find that the curriculum is a compromise between what may be called the *disciplinary* and the *useful* studies, between exercises that have an *absolute* and those which have a *relative* value in the development of the faculties. For some time past there has been a gradual intrusion of new subjects into the old course of study. The time devoted to classics has been reduced to make room for modern languages and science; the study of Euclid has

been supplemented by that of geometrical drawing; and logic and rhetoric have given way to political economy and hygiene. These changes have not been effected without detriment to the value of classical and mathematical studies as a means of culture. The pressure from without and the demands of parents have induced school authorities to overcrowd their curriculum, with the result that few if any subjects are well taught, the pupil too often retaining nothing more than a smattering of knowledge, and undergoing a very imperfect mental training. The curriculum of studies pursued in the majority of our secondary schools is the result of a struggle between the ideas of the Middle Ages and of modern times. Those who strongly advocate the retention of the classics, as the backbone of secondary education, seem to be unmindful of the fact, that these languages were originally taught, not so much for the sake of the mental discipline they afforded, as for their practical usefulness to those who were intended to enter the Church, and to enable the upper classes, who at that time were the only educated classes, to read the literatures of Greece and Rome, and to communicate with learned men in all parts of the world. The apparent uselessness of the exercise of Latin verse-making and of Latin composition is now defended on the ground, that the exercise is valuable as a discipline, and as affording the key to a knowledge of English and of other modern languages; and until recently parents were

not only discouraged from questioning the utility of such studies, but the inquiry was regarded as indicating a want of culture on the part of the questioner.

The study of the history of education shows that, until very recent times, there has always existed a relationship between education and the life interests of man. It is very true that the order in which these interests were regarded has greatly varied, and this fact indicates the importance of considering the educational system of any past period, or indeed of any foreign country, in connection with the activities, the practical needs, and the life interests of the people.

In ancient times, the development of trade and commerce was seldom if ever regarded as a national concern. Among the Jews, the building up of religious literature and the maintenance of religious rites were the chief objects of national concern. The cultivation of a sense of justice, with the view to the training of citizens and statesmen, occupied a similar place in the thoughts of the Greeks and Romans. The advancement of the Church was a matter of general interest among the cultured classes in mediæval Europe, and in varying degree, considerable importance was attached to individual strength and prowess. Education, therefore, in ancient times was mainly ethical, religious, and physical. Moreover, productive industry was in those days in the hands of artificers, who constituted a lower and in nearly all cases an illiterate class of the popu-

lation; and trade and commerce consisted of a system of barter in which each party was supposed to try to overreach the other, the practice of which was opposed to the ethical idea, and was consequently regarded as an unfitting occupation for the educated few. In Greece and Rome, practical pursuits were but little esteemed, and had little or no relation to the education of the people. Nevertheless, strange as it may appear, Mr. Payne is right in saying, that the prevailing type of education during the whole of the historic period was 'technical or professional, its purpose being to equip men for service as agents or instruments.'[1]

If we examine this proposition a little more closely, we shall see, that not only has there always existed a close connection between the education and the national interests of the people, but that the methods of instruction had a direct bearing upon the aims and objects of the education afforded.

To go back to one of the apparently most abstract systems of education—to the views of Plato, as set forth in the 'Republic,' we find that the object of education was to draw up from the region of shadows into the daylight of realities men of superior natural aptitude. To train the intellect to the contemplation of realities, and not the senses to the observation of things, was the aim to which, we are told, education should be directed. The practical use

[1] *Contributions to the Science of Education*, p. 196. W. H. Payne.

of any study was its least important recommendation. Arithmetic, for example, should be studied not for purposes of traffic, for which indeed it is useful, but as a discipline to conduct man to the contemplation of number in the abstract, and to the intelligible, indivisible unit, the *unum per se.* Geometry, like arithmetic, yields useful results in practice, but it is a mistake to teach it for the sake of its usefulness. 'Its real value is in conducing to knowledge and to elevated contemplations of the mind.' Perhaps the contrast between Plato's views and modern methods of instruction is nowhere more forcibly presented than in the statement: 'We cannot learn truth by observation of phenomena constantly fluctuating and varying. We must study astronomy as we do geometry, not by observation, but by mathematical theorems and hypotheses, which is a far more arduous task than astronomy as taught at present. Only in this way can it be made available to improve and strengthen the intellectual organ of the mind.'[1]

Here we have apparently an uncompromising statement of the absolutely disciplinary view of education: and yet it is not so; for education, as understood by Plato, was a special training, the object of which was to enable the superior mortals who received it better to discharge the several duties assigned to them in the scheme of his Republic, and

[1] Plato, *Republic*, vii., [illegible]

in this sense it was 'professional,' and had relation to the activities of life. But the passages I have quoted are interesting as showing that arithmetic, geometry and astronomy were generally taught with the view of their application to practical pursuits—a method of instruction against which Plato protests, as being suitable enough for ordinary purposes, but as not leading to the acquisition of the highest knowledge, on which conduct and judgment must ultimately depend.

Here we see, even in the system of education,[1] which is possibly the least practical that was ever elaborated, that the idea underlying it was not merely the development of the faculties, but the training of the mind with the view to its conducing to a man's conception of the highest good, and to his ability to discharge the highest functions of the State. In this scheme, opposed as it may seem to the utilitarian view, the writer places before him a distinct aim and object to which education should be devoted, and one which has reference to the higher interests of the State; and to this extent Plato's system compares favourably with the aimless characters of our present educational methods.

[1] 'After going through all these different studies the student will have his mind elevated so as to perceive the affinity of method and principle which pervades them all. . . . He will acquire that dialectical discerning power which deals exclusively with these intelligible forms, carrying on its processes by means of them only, with no reference to sensible objects.'—Grote's *Plato*.

In ancient Rome, the object of education was very different from that set forth in Plato's Republic. Its end was to train an accomplished orator. Oratory was an art to the practice of which nearly all learning was subservient. What constituted education at the opening of the Christian era is learned from Quintilian, whose well-known work on the subject deals almost entirely with the education of the orator, and concludes with a detailed account of the necessary requirements for the professional training of the public speaker.

In the Middle Ages we find, that the only really educated classes of the community were members of the Church, and that many of those who looked for preferment in the State received their early education as Churchmen. 'The study of the Scriptures themselves, and of such of the fathers as could be got (or extracts from them), was the governing subject in the whole scholastic system. Every study was esteemed by its bearing on the Bible, and limited by the views of the theologians.'[1] In these schools Latin, and to a less extent Greek, were the chief subjects of instruction, and the attention of the principal educational writers of the times was devoted to the consideration of the methods of acquiring most expeditiously a knowledge of the Latin language. Ascham's well-known work deals largely with this subject. The Jesuits were particularly successful in their method of teaching the Latin language, the study

[1] *Rise and Constitution of the Universities*, Laurie, p. 63.

of which was begun very early; although, according to Mr. Oscar Browning, 'they taught classics not because they were the best means of training the intellect, but because they were fashionable.'[1]

Many of our present criticisms are only an echo of those heard nearly 300 years ago. Comenius frequently complains that 'youth was delayed with grammar precepts infinitely tedious;' and he proposes a more practical method of familiarising children with the Latin tongue. But what I particularly wish to point out is that the importance which all these educational authorities attached to a knowledge of Latin was owing to its usefulness in the life-work of all educated men of the times. The impetus which the Reformation gave to education, by exalting to a duty the ability to read and understand the Scriptures, left the means and methods of instruction very much where they were. But the complaints we now hear of the too exclusive study of the Latin language recall similar complaints which were heard when Latin was far more practically useful than it is at present. A writer of the sixteenth century tells us, 'We are in bondage to Latin. The Greeks and Saracens would never have done so much for posterity if they had spent their youth in acquiring a foreign tongue.' And Locke well says: 'Can there be anything more ridiculous than that a father should waste his own money and his son's time in setting him

[1] *Educational Theories*, p. 125.

to learn the Roman language, when at the same time he designs him for a trade wherein he, having no use for Latin, fails not to forget that little which 'tis ten to one he abhors for the ill-usage it procured him?'[1]

Whilst the Church and the Law continued to be the two learned professions, the classical languages remained the chief instruments of a gentleman's education; and the ascendency of the Church over education gave to these languages a constantly increasing importance in the school curriculum. The influence of individual reformers availed very little. The advantage of teaching through the medium of *things* rather than of *words* was early seen, but no new instrument of education had as yet been forged. Experimental science was still in its infancy, and no one then thought of making it a subject of school instruction.

Speaking of natural philosophy, Locke says, 'Perhaps I may think I have reason to say we never shall be able to make a science of it. The works of nature are contrived by a wisdom and operate by ways too far surpassing our faculties to discover, or capacities to conceive, for us ever to be able to reduce them to science.' Even Rousseau, who strikes the key-note of technical education in his 'Emile,' produced in England very little effect, and his strong denunciation of book knowledge, as compared with

[1] *Locke on Education*, Quick's edition, p. 138.

original observation and experience, did very little to alter the common methods of instruction. The education which Rousseau advocated was distinctly in advance of his times. The professions did not then exist for which a thoroughly realistic education was necessary, and his advice to people to study *nature* and *things* was unheeded because the road to fame and position still lay in the study of *books* and of *words*. Rousseau was right; and we are now following his counsel in pointing out that the true development of the faculties consists in bringing them into direct relationship with the external world. Unconsciously, he unveiled by anticipation the whole method of technical instruction in the well-known words, 'mesurez, comptez, pesez, comparez.' But not only was he crying in a wilderness, but the system of education he advocated was out of relation with the occupations with which the majority of educated people were then engaged. Herbert Spencer, who in many instances improved upon Rousseau's precepts, tells us, that to prepare us for complete living is the function that education has to discharge; and that to do so, it must have reference to the activities in which we are to be engaged, and therefore to the life-interests of the individual.

It is interesting to note, as bearing upon a vexed educational question, which is being much discussed in Germany, but which we are gradually solving in a practical way, that the universities were originally.

or soon after their foundation, specialised or professional schools. It was a characteristic of a university, as distinguished from a mere Arts school, that it should teach law, medicine, and theology. Professor Laurie dwells upon this point in his little book on the 'Rise and Constitution of Universities;' and, after showing how the University of Salerno was at first a school for teaching medicine, and that of Bologna a school of law, he tells us, that 'not only were the infant universities specialised schools, but their primary purpose, as indeed manifestly follows from their specialisation, was a "professional" one. They had practical ends: their aim was to minister to the immediate needs of society.'[1] The new faculty to which the present needs of society have given rise is that of 'engineering' in the widest signification of the term; and the history of university education, and its development in England and in other countries, clearly point to the inclusion of this domain of knowledge among the faculties of a modern university.

Now I have tried to show, by reference to passages in the history of education, that a relationship has been recognised, as subsisting in past times, between education and the practical needs of life. I have, also, indicated some of the causes which have, so to speak, fossilised the education of this country, leaving us a system altogether out of harmony with the changed interests and requirements of the people. What

[1] Laurie, p. 109.

served its purpose well enough two or three centuries ago has been made to do duty in the present day, when the practical needs of the people are to a great extent new, and the number of professions or occupations, which demand advanced scientific knowledge and high intellectual training on the part of those who pursue them, has largely increased.

The necessity for a new departure in education is due to circumstances which have affected the conditions under which trade and commerce are now carried on. To these circumstances, reference will be made in subsequent chapters. They are mainly the result of the alteration in the methods of production, consequent on the use of labour-saving machinery, and to the changed conditions, under which the commerce of the world is pursued, consequent on improved facilities of locomotion and of verbal communication. Nearly all the differences that distinguish productive industry and mercantile business as pursued to-day and a century ago are referable to these two causes. The arts of both production and distribution have become more scientific, and dependent to a greater extent upon acquired knowledge and skill than upon unaided native intelligence. One feature of these changed conditions is, that the knowledge and, in some cases, the skill, which are now needed for industrial purposes, can no longer be adequately obtained in the actual practice of a trade, but require, as in the cases of law and medicine, a

preliminary training or specialised school instruction.

It follows, therefore, if education is to have any relation to the needs of life, that the nature of these new needs must be considered in determining the kind of instruction to be given in our schools; and this is what the advocates of technical education have been urging during the last ten years and more. Those who have seen how aimless is much of the instruction of our elementary and higher schools, and how ill adapted it is as a preparation for the real work of life, may appear to have been guilty of some exaggeration in representing the advantages of suitable training for developing and improving our trade and commerce. The cry for technical education, which has been called 'a vague cry,'[1] but which is daily growing stronger and more definite, is mainly a demand that the education which our children receive shall be such as to fit them for the work in which they are likely to be engaged, and that the subjects and methods of instruction adopted in our schools shall be determined with a view to this end. Those who advocate technical education do not regard the teaching of trades or the acquisition of handicraft skill as its real object; nor are they desirous of stocking the minds of workmen with mere technical information. Such information may possibly be obtained from handbooks, in which the results of the investigations of others are carefully

[1] Lord Armstrong, *Nineteenth Century*, July 1888.

tabulated and made available for all who can read and understand. But it is important that the persons who use such books shall be capable of applying the information they derive from them; and this is the more necessary in the case of those who are chosen to act as foremen, and whose duty 'requires them,' as Lord Armstrong tells us, 'to work more with their brains than with their hands.' The cry for technical education is 'vague,' because it has a different significance according to the source from which it emanates. It means one thing to the workman and another thing to the foreman, and, again, something different to the manager or manufacturer. It is not the same in reference to hand work as to machine work, and it changes again when considered in connection with scientific invention or artistic design. Those who think of technical education in relation to any single industry fail to understand the meaning of the cry that is raised by those who are engaged in other trades. Each knows where his own shoe pinches, but has little sympathy with the complaints of others. The present demand for technical education, however, is real and earnest; and how differently soever it may be interpreted, it means that the education that is to fit men for trade and commerce must be practical and adapted to the needs of industrial life, and that facilities for obtaining such an education must be freely offered to the whole army of persons, who are employed directly or indirectly in

producing and distributing the necessaries and luxuries of life. We may talk vaguely about the aim of education being the development of the faculties, the training of the mental and physical organs; but such development and training must be effected by instruments and means appropriate to the end in view. When I hear the importance of mere training, without reference to its object, unduly insisted upon by educational theorists, I feel inclined to retort that, if the sharpening of the wits be the sole end of education, I know of few subjects which might with more advantage be introduced into our schools, to stimulate observation, and to develop the powers of rapidly drawing inferences and of calculating probabilities, than modern whist; and yet the advocates of the disciplinary theory are scarcely likely to recommend that Cavendish shall take its place as a school textbook by the side of Euclid and the Latin primer.

Useful knowledge is not altogether despicable; nor is it unimportant that mental training should be effected by exercises that conduce to the acquisition of serviceable information and of aptitudes of real value in practical life.

In the future, we may expect that education will be governed to a much greater extent than hitherto by the following principles:

1. In the selection of subjects of instruction, preference should be given to those subjects that are likely to prove practically useful in the business of life.

2. These subjects should be so taught as to develop to the fullest extent the sense organs and the faculties of the mind.

It is for teachers to devise methods for making what may be called useful studies yield the necessary mental discipline. Almost any subject of instruction may be made a liberal study if so taught as to bring out the innate powers of the student's mind, to make him observe and think, and desire to know all he can concerning it. If instructors can be found capable of so teaching the subjects of the 'New Curriculum,' and likewise the principles of science in their application to different trades, the problem of industrial education, both as regards the general or preparatory, and also the supplementary or professional training of our artisans and of their employers, will be practically solved.

CHAPTER II.

TECHNICAL EDUCATION—ITS AIM AND SCOPE.[1]

THE special education, the object of which is to train persons in the arts and sciences that underlie the practice of some trade or profession, is technical education. Schools in which this training is provided are known as technical schools. In its widest sense technical education embraces all kinds of instruction that have direct reference to the career a person is following or preparing to follow; but it is usual and convenient to restrict the term to the special training which helps to qualify a person to engage in some branch of productive industry. This education may consist of the explanation of the processes concerned in production, or of instruction in art or science in its relation to industry, but it may also include the acquisition of the manual skill which production necessitates.[2] The term 'technical,' as applied to

[1] Reprinted, by permission of the publishers, with some additions and alterations, from the *Encyclopædia Britannica*, 9th edition, vol. xxiii.

[2] In the Technical Instruction Bill introduced into Parliament in May 1888, technical instruction is defined as 'instruction in the principles of science and art applicable to industries, and in the appl.

education, arose from the necessity of finding a word to indicate the particular kind of training which was needed in consequence of the altered conditions of production during the present century. Whilst the changed conditions of production, consequent mainly on the application of steam power to machinery, demand a special training for those who are to be engaged in productive industry, the prevalent system of education has been found to be not so well adapted as it should be to the requirements of these persons, and schools are wanted in which the necessary instruction can be obtained. Other circumstances, resulting mainly from the application of steam power to machinery, have rendered technical education necessary. Production on a large scale has led to a great extension of the principle of the division of labour, in consequence of which it is found economical to keep a man constantly engaged at the same kind of work. Thus employed, the workman learns little or nothing of the process of the manufacture at which he assists, or of other departments of the work than the particular one in which he is employed, and his only opportunity of acquiring such knowledge is outside the workshop or factory,—in a technical school. The economy effected by the division of labour has

cation of special branches of science and art to specific industries and employments.' This definition includes instruction in science, art, and technology, but does not include 'manual instruction,' which is separately defined, but which, under conditions which will be fully considered later on, is a part of technical education.

led to the extension of the principle to other industries than those in which machinery is largely employed. There are many trades in which manual skill is as necessary now as ever, but even in these the methods of instruction prevailing under the system of apprenticeship are now almost obsolete.

In many industries, including trades in which machinery is not as yet extensively employed, production on a large scale has increased the demand for unskilled labour, numbers of hands being required to prepare the work to be finished by a few artisans. Rapidity of execution is attained by keeping a workman at the same work, which after a time he succeeds in mechanically performing, and continues to do until some machine is invented to take his place. In most trades, as formerly practised, the master employed a few apprentices who assisted him in his work, and who learnt from him to understand the details of their craft, so that, when the term of their apprenticeship was over, they were competent to practise as journeymen. But now the master has neither time nor opportunity to instruct young lads, and the old relation of master and apprentice is changed into that of capitalist and workman. In consequence of these altered relations between employer and employed, there is an acknowledged want of properly trained workmen in a number of trades in which skilful handwork is still needed; and in these trades a demand has arisen for technical schools, or some other substi-

tute for apprenticeship, as a means of suitably training workmen and foremen. The ever-increasing competition in production has led to the employment, in many trades, of children to do work of a mechanical kind requiring little skill; but, whilst thus employed, these young people have little opportunity of learning those parts of their trade in which skill and special knowledge are needed; and when they are grown up, and seek higher wages, they are dismissed to make room for other children. Numbers of young men are thus thrown upon the labour market, competent to do nothing more than children's work, and to earn children's wages, and knowing no trade to which they can apply their hands. To remedy this, by creating some substitute for the old apprenticeship, is one of the objects of a system of technical education.

A complete system of technical education should provide necessary instruction for the different classes of persons engaged in productive industry. It is usual to divide these persons into three classes:—(1) Workmen or journeymen; (2) foremen or overseers; (3) managers or masters.

The industries in which they are employed may be grouped under four heads:—(1) Those involving the use of extensive machinery, such as iron and steel manufacture, machine making, the textile industries and some of the chemical trades; (2) those which mainly require the use of hand tools, as cabinet-making, brick-work, plumbing, and tailoring; (3) those

depending on artistic skill, as wood and stone carving, metal-chasing, decorative work, and industrial designing generally ; (4) agriculture in all its branches. These industries will be referred to as manufactures, handicrafts, art industries, and agriculture. The foregoing classification comprises groups which necessarily, to some extent, overlap one another. Every factory contains a carpenter's and smith's shop, and handicraftsmen of group (2) are required in every manufacturing concern. Whilst the industries in which hand labour is exclusively employed are becoming fewer and fewer, there are many trades which, owing to the frequent invention of labour-saving appliances, are passing gradually from the class of handicrafts to that of manufactures. In these trades, of which watch and clock making and boot and shoe making may be taken as examples, there is still a demand for goods largely if not entirely produced by hand work. In such trades, owing to the absence of facilities for instruction in the ordinary shops, there is a want of skilled hand labour, which there is an increasing difficulty in satisfying ; and to supply this want technical schools of different kinds have been established. Then, again, there are many branches of manufacturing industry which greatly depend for their success upon the designer's art, and it is necessary that the industrial designer should possess a knowledge of the processes of the manufacture in which his designs will be utilised, as well as of the

properties and capabilities of the material to which they will be applied. Indeed, it is the possession of this knowledge which mainly distinguishes the industrial designer from the ordinary artist. To determine the best training for such designers is one of the problems of technical education. There are many trades, too, in which the handicraftsman and the designer should be united. This is the case in such industries as wood-engraving, metal-chasing, and silversmith's work. In these and other trades the true artisan is the artist and handicraftsman combined.

In order to reconcile some of the different views which are held as to the objects of technical education, it is necessary to keep in mind the broad distinction, above referred to, between the conditions of production on a large scale, as in those industries in which goods are manufactured by the use of extensive labour-saving machinery, and in those trades in which hand work is chiefly employed. Much of the diversity of opinion regarding the objects of technical education is due to the difference of standpoint from which the problem is regarded. The volume of the trade and commerce of Britain depends mainly on the progress of its manufacturing industries. It is these which chiefly affect the exports and imports. The aim of manufacturers is to produce cheaper and better goods than can be produced by other manufacturers at home or abroad; and technical education is valuable to them in so far as it enables them to do so. But

the artisan engaged in hand industries looks to technical education for the means by which he may acquire a knowledge of the principles of his trade, which the absence of the system of apprenticeship prevents him from acquiring in the shop. Hence, the artisan and the manufacturer approach the consideration of the question from different sides. To the spinner or weaver who almost exclusively employs women to tend his machinery, or to the manufacturing chemist whose workpeople are little more than labourers employed in carrying to and fro materials, knowing little or nothing of the scientific principles underlying the complicated processes in which they are engaged, the technical education of the workpeople may seem to be a matter of little moment. What such manufacturers require are the services of a few skilled engineers, artistic designers, or scientific chemists. From the manufacturer's point of view, therefore, technical instruction is not so much needed for the *hands* he employs in his work as for the *heads* that direct it. But in trades in which machinery plays a subsidiary part, technical teaching takes the place of that instruction which, in former times, the master gave to his apprentice, and the workman looks to it to supply him with the knowledge of the principles and practice of his trade, on the acquisition of which his individual success greatly depends. In the former class of industries, technical education is needed mainly for the training of managers; in the

latter, for the training of workmen. Hence has arisen a double cry—for the teaching of art and of the higher branches of science, with a view to their application to manufacturing industry, and for the teaching of trades, and of the scientific facts which help to explain the processes and methods connected with the practice of these trades. This double cry has led to the establishment of technical universities and of trade schools.

Owing to the conditions under which manufacturing industry is now carried on, it is difficult to select competent foremen from the rank and file of the workmen. The ordinary hands gain a very limited and circumscribed acquaintance with the details of the manufacture in which they are engaged, and have little opportunity of acquiring that general knowledge of various departments of work, and of the structure of the machinery in use, which is essential to the foreman or overseer. It is in evening technical classes that this supplementary instruction, which it is the workman's interest to acquire and the master's to encourage, can be obtained. The history of invention shows how frequently important improvements in machinery are made by the workman or minder in charge of it, and adds weight to the arguments already adduced for giving technical instruction to persons of all grades employed in manufacturing industry. To these advantages of technical education, as affecting the workmen themselves as well as

the progress of the industry in which they are engaged, must be added the general improvement in the character of the work produced, resulting from the superior and better trained intelligence of those who have had the benefit of such instruction.

Schools in which the course of instruction is not specialised with a view to any particular industry, but is so arranged as to form a general preparation for manufacturing or other trade pursuits, are often spoken of as professional, technical, or trade schools ; but such schools must be distinguished from apprenticeship schools, the object of which is to teach trades. Of the former class of schools there are excellent examples in the different countries of Europe as well as in the United States, and some few have recently been established in the United Kingdom. Of the latter class the best examples are found in France and Austria.

The study of such schools, and of the means of providing fitting education for the different classes of producers, may be simplified by a statement of the following propositions :—

1. The ordinary education of all persons who are likely to be engaged in productive industry should be determined by the general requirements of their future work. This proposition affects the curriculum of all schools in which different classes of producers are to be trained, *i.e.* of primary, secondary, and higher schools, and involves the consideration of the

extent to which, in such schools, modern languages, science, drawing, and manual instruction should take the place of literary and classical studies.

2. Special schools or classes should be established (*a*) for instruction in art, and in those sciences which serve to explain the processes of productive industry, including agriculture, manufactures, and engineering, as well as in the application of art and science to these departments of industry; (*b*) for the teaching of, and in certain cases for practice in, various handicrafts or trades.

3. The special schools should be adapted to the requirements of the different grades of workers in different localities, and to the different kinds of work in which they are, or are likely to be, engaged.

A survey of the technical schools in foreign countries shows how these different requirements are met. Owing to the complexity of the problem, a complete or an ideal system of technical education is nowhere to be found. Schools have been created to meet local and present wants, and the greatest variety exists in the attempts that have been made to establish schools in accordance with the foregoing propositions.

1. *Workmen.*—Many attempts have been made to provide a substitute for apprenticeship, but hitherto with no great success. Two classes of workpeople have to be considered—(1) those engaged in manufacturing industries, and (2) those engaged in handi-

craft industries. The education of all classes of workpeople begins in the public elementary schools; and, in view of the future occupation of the children, it may be taken for granted that primary instruction should be practical, and should include drawing and elementary science, with some amount of manual training for boys, and with needlework, cookery, and domestic economy for girls. In nearly every country of Europe, and in the United States, primary instruction includes drawing, in addition to reading, writing, and reckoning. In England this is not yet the case, drawing being taught in very few schools outside of the jurisdiction of the London School Board. In France, Belgium, Holland, and Sweden handicraft instruction is generally included in the curriculum of elementary schools. Rudimentary science is also taught in nearly all the primary schools of Europe. Modelling is taught both to boys and girls in many Continental schools; and in Sweden 'slojd,' or elementary woodwork, in which simple and useful articles are constructed with the fewest possible tools, is taught with considerable success to children of both sexes.

In Germany and Switzerland, there exists an excellent system of evening continuation schools, known as *Fortbildungs-* or *Erganzungs-Schulen*, in which the instruction of the children who leave school before fourteen, and of those who leave at that age, is continued. In England, an attempt is being made to attract children to evening schools by means of

recreative classes. These classes are intended to continue the child's general education, and to supplement it by some amount of practical teaching between the time that he leaves the elementary school and is prepared to take advantage of evening technical instruction. The training of most workpeople, and of nearly all those who are engaged in manufacturing industry, consists of—(1) primary teaching in elementary schools; (2) practice in the factory or shop; (3) evening technical instruction.

Evening classes in all the principal towns throughout Europe have been established for teaching drawing, painting, and designing, and the elements of science in their application to special industries. On the Continent these classes are mainly supported by the municipalities, by the chambers of commerce, by industrial or trade societies, by county boards, and in some cases by the fees of the pupils. They receive little or no support from the State. They are well attended by workpeople of all grades, who are encouraged by their employers to profit by these opportunities of instruction. In England evening technical instruction is more systematically organised than in any other country. It is under the direction of the committee of the council of education known as the Science and Art Department, assisted by the City and Guilds of London Institute for the advancement of technical education, an institute founded and supported by the Corporation and by several of

the livery companies of London. The Department encourages instruction in pure science and in art ; the Institute, in the application of science, and to some extent of art also, to different trades.

Certificates are awarded and grants are made on behalf of properly registered teachers on the results of the examination of their students. The directory of the Department contains a detailed syllabus of the twenty-five different subjects on the teaching of which grants are paid, and in the programme of the Institute are found syllabuses of instruction in the technology of fifty different trade subjects. In the evening classes organised by the Department, as well as in those in connection with the Institute, the workman or foreman engaged in any manufacturing industry has the opportunity, by payment of a very small fee, of studying art in all its branches, science theoretically and practically, and the technology of any particular industry. Provided his early education enables him to take advantage of this instruction, no better system has been suggested of enabling workmen, whilst earning wages at an early age, to acquire manual skill by continuous practice, and at the same time to gain a knowledge of the principles of science connected with their work and explanatory of the processes of the manufacture in which they are engaged.

For those engaged in handicraft trades this evening instruction is equally valuable, and in many parts

of Europe there exist evening trade schools, in which the workman is able to supplement the 'sectional' practice he acquires in the shop by more general practice in other branches of his trade. In Vienna, for example, and in other parts of Austria, there are found practical evening classes for carpenters, turners, joiners, metal-workers, and others; and similar classes have recently been established in England. In London, the new Polytechnics about to be erected on the model of the one in Regent Street will contain many such classes, and will also provide rational amusements for the students. Throughout Europe, schools for weaving, with practical work at the loom and pattern designing, have existed for many years.

To provide a training more like the old system of apprenticeship, schools have been established in many parts of Europe which are known as professional, trade, or apprenticeship schools (*écoles professionnelles, écoles des apprentis, Fachschulen*). The object is to train workmen; and the pupils, after completing their course of instruction in such a school, are supposed to have learnt a trade. The school is the substitute for the shop. In such a school the pupils have the advantage of being taught their trade systematically and leisurely, and production is made subsidiary to instruction. But the system of production is necessarily artificial, and the pupil is less likely to acquire excellence of workmanship and smartness of habit than in the mercantile shop, under the strain of

severe competition. Moreover, the cost of maintenance of these schools renders it impossible to look to them as a general substitute for apprenticeship. By sending into the labour market, however, a few highly trained workmen, who are absorbed in various works and exert a beneficial influence on other workmen, these schools serve a useful purpose. Schools of this kind have been tried with more or less success in different countries. In Paris there is the well-known *Ecole Diderot* for the training of mechanics, fitters, smiths, &c.; and similar schools have been established in other parts of France. A furniture-trade school of the same category has recently been opened in Paris, and for many years a society of Christian Brethren have directed a large school in which several different trades have been taught. In this establishment, situated in the Rue Vaugirard, all the secular and general instruction is given gratuitously by the brothers, and in the several shops attached to the school skilled workmen are employed, who instruct the pupil apprentices, and utilise their labour. This system combines many of the advantages of shop work and school work, but it depends financially for its success upon the religious spirit which actuates its promoters and supporters. The Artane school, near Dublin, is conducted on somewhat similar principles, but is intended for a lower class of children. In Austria, particularly in the rural districts, there are numerous schools for the training of carpenters, joiners, turners,

cabinet-makers, workers in stone and marble, in silver and other metals, &c. Schools of the same class are found in Germany, Italy, and elsewhere. It is only in certain cases, however, that apprenticeship schools can be said to satisfactorily answer the purpose for which they have been established. Where a new industry, especially in rural districts, has to be created; where decaying industries need to be revived; where machinery is superseding hand work, and, owing to the demands for ordinary hands, there is a dearth of skilled workmen; where through the effects of competition and other causes the trade is carried on under conditions in which competent workmen cannot be properly trained in the ordinary shop—in these cases, and in various art industries, an apprenticeship school may prove to be the best means of training workmen and of advancing particular trades.[1] Generally, an apprenticeship school should be looked upon as a temporary expedient, as a form of relief applied at the birth or during any temporary depression of a particular industry. The proper training school for workmen is the factory or shop.

2. *Foremen.*—The foreman must be familiar with the various branches of work he is to overlook, and the training which the workman receives in the factory or shop affords him but scanty opportunities

[1] In many parts of Ireland and in some of the rural districts of Britain the experiment of teaching certain trades in schools might be tried. The establishment of a good weaving school might be the means of bringing back the silk trade to London.

of obtaining this general knowledge. The foreman needs also a generally superior education. How then are foremen to be trained? The problem is somewhat easier than that of training workmen, because the number required is fewer. The variety of schools in Europe devoted to this purpose is very great. There are three distinct ways in which foremen are being trained.

(*a*) The evening technical classes in Britain and on the Continent offer to ambitious workmen an opportunity of acquiring a knowledge of other departments of the trade than those in which they are engaged, as well as of the scientific principles underlying their work. These classes serve the double purpose of improving the workpeople and of affording a means of discovering those who are best fitted to occupy higher posts.

(*b*) Special schools have been established for the training of foremen. There are many trade schools of this kind in which selected boys are received after leaving the elementary school. The best known are those at Châlons, Aix, Nevers, Angers, and Lille in France. These schools are intended for the training of foremen in engineering trades. They are State institutions, in which practical mechanical work in the shops is supplemented by theoretical instruction. The first of these schools was founded in 1803. The course lasts three years, and the number of students in each school must not exceed three hundred. The

students spend from six to seven hours a day in the workshop, and are trained as fitters, founders, smiths, and pattern-makers. As in all such schools, saleable goods are produced ; but, as production is subordinated to instruction, the school does not bind itself to deliver work at a given date, and therefore does not compete with any manufacturing establishment. The students on leaving these schools are competent at once to undertake the duties of foremen, managers, or draughtsmen. At Komotau, Steyr, Klagenfurt, Ferlach, and many other places schools have been established on somewhat similar principles. In Germany there are special schools for the training of foremen in the building trade, which are chiefly frequented in the winter, and numerous schools are found in all parts of the Continent for the training of weavers. At Winterthur, in Switzerland, a school has been established for the training of foremen. In Italy there are numerous technical institutes, the object of which to is prepare young men for intermediate and higher posts in industrial works. In the United States, the manual training schools, the number of which is rapidly increasing, have somewhat similar objects. In London, the Finsbury technical college of the City and Guilds of London Institute has a day department,, the main purpose of which is the training of youths as foremen, works managers, &c. ; but in this school, as well as in those last mentioned, the character of the instruction deviates con-

siderably from that given in French schools, and aims rather at preparing youths to learn, than at teaching them, their trade.

(*c*) A third method adopted for the training of foremen is by encouraging selected children of the ordinary elementary schools to continue their education in schools of a higher grade of a technical character. It is thought that, by developing to a higher degree the intelligence and skill of those children who show aptitude for scientific and practical work, they will be able, when they enter the shop, to learn their trade more quickly and more thoroughly, and to acquire that general knowledge of their work, and to exhibit those special aptitudes, which may qualify them for the position of foreman or manager. The education given in these schools, although having direct reference to the future career of the pupil, is mainly disciplinary in character, and consists of the subjects of primary instruction further pursued—of drawing, modelling, science, mathematics, and manual exercises. The curriculum is varied to some extent according to local requirements, the technology of the staple industries forming in many cases part of the instruction. Such schools, under varied forms, have been established in most Continental countries, some of the best examples of them being found in Paris, Lyons, Rheims, Rouen, and in other towns of France. A large number of poor children showing talent are selected from the primary

schools and are received into these schools with scholarships; and the objection sometimes urged against the establishment of higher elementary schools—that the better classes only are able to benefit by them—is thus obviated. In Germany, the real-schools in which Latin is not taught, known as *Ohnelatein-Realschulen*, have very nearly the same objects as the higher elementary schools of France. The instruction in these German schools is not yet so practical as in the schools of France. Drawing is always well taught, and the schools generally contain good chemical laboratories, as well as collections of physical apparatus and museums. From the children of these schools the ranks of foremen are largely recruited. They receive no special trade instruction, but the general training is so arranged as to qualify them for higher posts in industrial works. The cost of this higher education seldom exceeds 3*l.* per annum. In Bavaria it is two shillings a month. In most of these schools, as well as in the chief intermediate commercial schools, the exit certificate exempts a lad from two of the three years' compulsory military service, and this regulation, ot which nothing corresponds in England, is an incentive to parents to allow their children to receive higher instruction, which operates very forcibly in largely increasing the number of well-educated youths in Germany. In these opportunities for higher education England is still very deficient, and the complaint

is generally heard of the difficulties of obtaining competent foremen.

3. *Masters.*—The best special schools for the training of future masters, managers, engineers, manufacturers, and industrial chemists are in Germany, and are known as technical high schools or polytechnic schools. Schools of a similar character are found in other countries, and in England the facilities for higher technical education have within the last few years greatly improved.

In Germany the polytechnic or *technische Hochschule* is an institution of university type in which the education has special reference to industrial purposes. In many respects the teaching coincides with that given in the universities. The chief distinction consists in the arrangement of courses of instruction in the several departments, in the admission of students having a non-classical preliminary training, in the absence of certain faculties found in the university and in the addition of others. It is not correct to say that the polytechnic is a professional school as distinguished from the university; for the faculties of law, medicine, and theology give to the university as distinctly a professional character as the faculty of engineering gives to the polytechnic. Nor can it be said that the scientific studies at the universities are less practical than at the polytechnic. For, whilst workshops for instruction in the use of tools are found in very few of the polytechnic schools, the labora-

tories, for the practical study of chemistry and physics, are perhaps better fitted and are under more eminent professors at some of the German universities than at the polytechnic schools. At the same time, engineers of every description, architects, and builders, besides a great number of manufacturing chemists, find in the polytechnic the scientific and technical training which the lawyer or physician, and in many cases the industrial chemist, seeks in the university.

In some of the large cities—in Berlin, Vienna, and Munich, for instance the university and polytechnic co-exist; and in certain cases, in which a very special training is required to fit a youth for his career, the German student, after spending three or four years at a polytechnic school, passes on to another institution, such as a dyeing school, in which his studies are further specialised with a view to his future work.

In France, the institutions in which the highest technical instruction is given are centred in the capital. There are a large number of provincial colleges where the education is somewhat more practical, but where the mathematical and scientific teaching is not carried to so high a point. Such are the *Ecole Centrale* at Lyons, the *Ecole des Mineurs* at St. Etienne, and the *Institut du Nord* at Lille. The *Ecole Centrale* of Paris, in which the majority of French engineers who are not employed in the Government service are trained, is a rare instance of an institution for higher technical instruction which

is self-supporting and independent of Government aid.

In Switzerland, the federal polytechnic of Zürich is similar to the polytechnic schools of Germany and Austria. Italy has three superior technical institutes—one at Milan, one at Turin, and one at Naples—in which technical education is given on the same lines as in German polytechnic schools. Holland has an excellent institution at Delft, which was opened in 1864; and in Russia the imperial technical school at Moscow is a high-class engineering school, in which the theoretical studies are supplemented, to a greater extent than in the German schools, by workshop practice.

In some of the German schools the fees charged vary according to the number of lectures and to the number of hours of practical work which the student takes per week. Thus, at Munich, the entrance fee for each student is 10*s.*, and the lecture fee is 2*s.* 6*d.* for each hour's lecture per week, including the use of materials. At Zurich, the cost of instruction in the chemical department, including laboratory practice, does not exceed 12*l.* per annum, and in other departments it does not exceed 4*l.* per annum. At Delft, the student pays about 16*l.* per annum for a complete course.

In England, there is a growing tendency to associate technical with university education. This is mainly owing to the fact that the colleges which have

recently been established to give university education are poorly endowed, and have found it necessary to attract students by meeting the increasing demand for technical instruction. Most of the provincial colleges may indeed be regarded as technical schools with a literary side. In order that they may provide university education in addition to sound technical instruction, it is necessary that they should be placed on a financially satisfactory footing by means of State endowment. Of the more recently erected English colleges, the Owens College at Manchester is the most important, combining the faculties of a German university with those of a polytechnic school. The Yorkshire College, Leeds, possesses a special school for the teaching of weaving and dyeing. Other somewhat similar institutions are found in Birmingham, Newcastle, Sheffield, Nottingham, Dundee, Cardiff, and elsewhere. The university of Edinburgh has a good school of chemistry, physics, and engineering, and the university of Glasgow has been long distinguished for the excellence of its physical laboratories. In University College and King's College, London, the metropolis possesses two institutions, each of which may be likened to a University and a polytechnic combined. In the university of Cambridge there are mechanical workshops in connection with the chair of engineering. The Royal School of Mines and the normal schools of science and art in South Kensington are the only technical institu-

tions in England supported by State aid. The Central Institution in London has more in common with the German polytechnic school than any other institution in Britain. This school is designed for the technical instruction of teachers, engineers, architects, master builders, and industrial chemists. It was built and equipped at a cost of 100,000*l.*, and is at present maintained by an annual grant from the City and Guilds of London Institute.

Such is a brief outline of the means provided for the technical education of masters in different parts of Europe. It will be seen from the foregoing statement that efforts are now being made to bring Britain more nearly on a level with other countries in the provision of those kinds of instruction which are best adapted to the different classes of producers. But as yet only a beginning has been made, and in England the number of technical students receiving the higher education is far less than in Germany.

CHAPTER III.

MERCANTILE TRAINING—SCHOOLS OF COMMERCE.

THE question of how best to adapt our existing educational machinery to the requirements of commercial life, and of the additions, if any, that should be made to it, is now engaging the serious attention of merchants, manufacturers, teachers, and statesmen. The importance of the question is no longer doubted, and discussions of the subject are invited, with the view of eliciting the opinions of persons who, by their own knowledge and experience, are able to contribute to the solution of what must be regarded as a problem of national importance. To this end, an important conference was held under the auspices of the Chamber of Commerce, on November 23, 1887, when Sir John Lubbock, who is specially qualified to speak on this subject, delivered a very suggestive address, in which he pointed out many of the reasons which prevent our children from obtaining in our secondary schools, as at present organised, the preliminary training which might best prepare them for practical and commercial pursuits. He was followed by Dr.

Percival, who rightly said: 'The true educational method for an industrial and commercial population like ours is to fix our attention far more than hitherto on the practical needs of our population, and so to endeavour to liberalise what were called the practical studies; and to dismiss, once for all, the old-world idea that studies which have a direct bearing on the needs of boys growing up in our schools somehow lose their humanising qualities.'

The development of our trade and commerce may be said to depend on knowing not only how to produce at least cost what is most wanted, but also how to buy and sell with the utmost advantage. We may take it for granted that the full benefits of technical instruction will fail to be realised unless opportunities are afforded by which our youths may obtain that especial kind of training which is calculated to make them good business men.

The economy of production is closely associated with that of distribution in the machinery of commerce, and the connection between the factory and the merchant's office is very intimate, and tends daily to become more so. The progress of science is gradually converting the factory into a laboratory, in which raw materials are altered in substance or in form; and the success of productive industry depends on the skill and ingenuity with which this process of conversion is carried on. But mercantile success depends not only on the skill and ingenuity shown in the production

of goods, but also on the care exercised in the purchase of the material employed, and on the special knowledge and ability displayed in the sale of the manufactured products. The highest technical knowledge might be employed in producing goods for which there was no demand; or, as has so frequently happened, for which the demand had ceased, and commerce would not thereby be advanced. Or, goods might be produced, excellent in quality, but unsaleable except at a loss at places already fully supplied. What is needed for the development of commerce is not only the faculty of *production*, but also of *distribution*. A market is a necessary adjunct to a factory.

The consideration of the kind of training which is best calculated to fit a person to buy and sell, and to engage in any of the operations, including banking operations, connected with the work of distributing, and of bringing home to the consumer, the products of industry, is the problem of commercial education.

The questions of technical and of commercial education are so closely associated, that it is difficult to consider them except in connection with each other. Speaking generally, technical education may be said to have reference to the work of *production*, and commercial education to that of *distribution*; but, as the character of the goods produced by the manufacturer must depend, to a great extent, upon the tastes and requirements of the consumer, which should be ascertained by those engaged in the work of distribution.

mercantile success may be regarded as a function of two factors, one of which has reference to the skill displayed in the processes of manufacture, and the other to the activity and economy shown in bringing the products of industry into the hands of the consumer.

Hitherto, owing to the necessity of previously considering the question of technical education, the closely allied question of commercial education has remained somewhat in the background. The progress that has been made during the last few years in providing the necessary supplemental instruction for persons engaged in *productive* industry is, on the whole, satisfactory. Our University Colleges, under the influence of the demand for technical teaching, have recently added on important technical departments. In the Polytechnic Institutions which it is proposed to erect in London on the model of the People's Palace, provision will be made for the technical instruction of a large proportion of the workpeople of the metropolis. The Charity Commissioners have framed schemes for the curriculum of endowed schools, in which science instruction and manual training occupy part of the time formerly devoted to the study of classics. Some of our School Boards have, so far as the iron regulations of the Code permit them, introduced the teaching of drawing, science, and handicraft into the schools under their control. The Science and Art Department has made it [illegible]

tions in science somewhat more practical, and has given more prominence to industrial designing in the teaching of art; and to the City Guilds is due the credit of having organised, in the principal trade centres throughout the kingdom, a large number of technical as distinguished from ordinary science classes, and of having thereby given a powerful impetus to the creation of technical schools.

This record of progress may be regarded as satisfactory, and the time has now come for considering the kind of training which is needed by young persons preparing for a mercantile career.

The altered conditions under which trade is now carried on have given to the solution of this problem a new and, until recently, a not sufficiently recognised importance. The application of science to the means of locomotion and of communication have changed many of the essential features of the geography of fifty years ago. Distant countries are now closely united by swift ocean steamers, by a network of rails, and by telegraphic wires. This development of scientific applications to the modes of transit and of communication has produced a revolution in our system of commerce, the effect of which we are only gradually coming to realise. It has intensified the severity of competition between different countries; it has diminished the value of the raw material in relation to that of the manufactured product; it has lessened the advantages due to natural resources; it has

narrowed the margin of profit, necessitating the exercise of the greatest economy in the management of the mercantile department of a manufacturing business, and the utmost vigilance in securing the advantages of differences of exchanges, and in searching, wherever they may be found, for new and promising markets. When we hear, as we often do, successful manufacturers and merchants speak discouragingly of the importance of commercial education, and tell us how, sent into the factory or office at an early age, they there acquired the practical experience to which they ascribe their fortune, we cannot but feel that such men overlook the fact that the conditions under which trade is now carried on are wholly different from what they were fifty years ago; and it is owing to this difference that a different and special kind of training has become indispensable. No one can contemplate the changes which have taken place during the present half-century without realising their levelling influence upon the development of commerce, and the growing importance, as a factor of mercantile success, of that wider knowledge which enables those engaged in commerce to understand, and to take advantage of, all favourable conditions in the conduct of business operations. The merchant's vision must extend beyond the limits of his own town or country. His observation must be widened, so that literally he may be able "to survey mankind from China to Peru." The range of his markets is con-

tinually extending, and his knowledge should be co-extensive with the area of his transactions.

The success which, owing to our natural resources, attended our early efforts to apply steam-power to productive industry, induced a feeling of over-confidence among our people, and led us to disregard the connection which ought to subsist between school-training and the business of life; whilst the absence of similar prosperity in other countries resulted in an earlier recognition of this important relationship. For this reason, technical and commercial schools were established abroad many years before the necessity for their creation was realised in this country; but the levelling influences of scientific progress, to which I have referred, have placed us at a comparative disadvantage with other countries, or rather have lessened the advantages we formerly possessed on account of our natural resources, and have made it imperatively necessary that we should seek compensation in the endeavour to reap all the benefit we can from the improved and adequate education of our industrial classes.

I. That our own school system does not afford the requisite training to enable our youths to compete on equal terms with the youths of other countries, especially of Germany, is shown by such evidence as may be found in the Reports of the Commissioners on 'Technical Instruction,' and on 'the Depression of

Trade and Industry,' as well as in the reports of several of our Consuls in different parts of the world. From these documents it appears that it is mainly owing to German competition that our foreign trade is shrinking, and it is in Germany that the most abundant provision has been made for the fitting educational equipment of young persons who are engaged in mercantile pursuits. The Commissioners tell us that the increasing severity of this competition, both in our home and neutral markets, is especially noticeable in the case of Germany, and that in every quarter of the world the perseverance and enterprise of the Germans are making themselves felt. 'In the actual production of commodities we have now few, if any, advantages over them; and in a knowledge of the markets of the world, a desire to accommodate themselves to local tastes or idiosyncrasies, a determination to obtain a footing wherever they can, and a tenacity in maintaining it, they appear to be gaining ground upon us.'[1]

This advance of German trade does not appear to be owing to any falling off in the efficiency of the British workman, but solely to the superior fitness of the Germans, due unquestionably to the more systematic training they receive, for mercantile pursuits. The Commissioners tell us that whilst, 'in respect of certain classes of products, the reputation of our workmanship does not stand as high as it formerly

[1] *Commissioners' Report*, p. 20 (75).

[illegible] They further state: "In the matter of education we seem to be particularly deficient as compared with some of our foreign competitors; and this remark applies not only to what is usually called technical education, but to the ordinary commercial education which is required in mercantile houses, and especially the knowledge of foreign languages."[2]

The recommendation[3] of the Commissioners that her Majesty's diplomatic and consular officers abroad should be instructed to report any information which appears to them of interest as soon as they obtain it, and that it should be as promptly published at home when received, has resulted in the publication of a series of reports, which fully bear out the conclusions at which the Commissioners have arrived with regard to the deficiencies of our commercial education, to the activity displayed by foreigners in the search for new markets, and to the readiness of manufacturers abroad to accommodate their products to local tastes and peculiarities.[4]

In several of the reports recently published, atten-

[1] *Commissioners' Report* (77).
[2] *Ibid.* (97).
[3] *Ibid.* [illegible]
[4] *Ibid.* (100).

tion has been called to the importance to this country of possessing an army of commercially trained agents, who shall be able to discover foreign markets, to inform English manufacturers as regards the requirements of these markets, and to push the sale of home-made goods.

The consul at Malaga, writing on the necessity of pushing our trade in Spain, says: 'Unless our manufacturers are prepared to make some sacrifice in this direction by the employment of commercial travellers acquainted with the language of the country, and qualified to study the requirements of their customers, they can, it is feared, hardly regain the ground that has been lost in this country. There are at Malaga a number of young German clerks, who, on their return home, will be well prepared for employment in German firms having business with this country.' [1]

According to the consul at Trebizonde, 'British trade would no doubt greatly develop by commercial travellers visiting the country with samples, studying the requirements of the people, and meeting local tastes in the nature, quality, and value of the goods most in demand.' [2]

Another consul tells us that 'the vast majority of British merchants have yet to learn the lesson, so well understood by their foreign competitors, that all the advertising pamphlets, journals, circulars, and

[1] *Annual Series* (125). [2] *Ibid.* (135).

letters of inquiry with which the consuls are inundated will never enable them to compete with the intelligent economical French and German commercial travellers, who are thoroughly acquainted with the language, manners, customs, and wants of the people in the highways and byways of the country, among whom they spread like a swarm of bees in unwearying collection of the honey, which will never stick to the British traders' illustrated reams of paper and ink.'

In a report of a visit to Kharkoff, Consul-General Perry says that, owing to the absence of travellers, British goods are at a discount, and the Germans have it all their own way. 'The landlord of the Grand Hôtel de l'Europe informed me that, during the last fair, thirty German travellers were staying at his hotel against one Englishman, and that more Germans were at other hotels and lodging-houses.'[1]

These statements, which might be considerably multiplied, show that our trade with foreign countries is distinctly suffering in consequence of the want of commercial knowledge and activity among our mercantile classes. At home, the pinch of competition is equally felt, and is due partly to the same cause. The answers to a circular addressed by the London Chamber of Commerce to the leading City houses have shown the extent to which foreign clerks are employed by commercial firms in London, and also,

[1] *Miscellaneous Series* (55).

what is less flattering to us, the reason of the preference shown for them. It appears that 35 per cent. of the firms replying to the circular employ foreign clerks, and that less than one per cent. of English clerks are able to correspond in any foreign language. From several of the answers received, it also appears that preference is given to foreigners on account of their generally superior education, and of their special qualifications for commercial work. According to many of the witnesses, 'the foreigner is, at present, the better "all-round" man; better equipped both with the special technical knowledge of his particular industry, and with the wider culture which enables him to adapt his knowledge and his training to the varying demands of modern commerce.' Now, not only is the recognition of this fact somewhat humiliating to us as a nation, but the fact itself serves to explain some of the causes of the success of foreign competition of which we complain. In the first place, every foreigner employed in an English firm displaces an Englishman, who might, and would be, so employed if only he were properly educated. Moreover, many of these foreign clerks, after having learnt what they can as regards our manufactures, our markets, and modes of conducting business, return to their native land to utilise that knowledge as our competitors and rivals; and even of those who remain here, and establish new firms, a large number, naturally, show a preference for foreign manufacturers with whom they

stand in relation, and from whom they obtain goods for the supply of the markets in which they deal.

It may not be out of place here to quote from a recent novel of Mr. Walter Besant his description of the German clerk, which experience shows to be only slightly over-coloured.

'In every office,' says the German, 'there must be clerks who can write and speak foreign languages. Your young men will not learn them, and your schools cannot teach them. Then we come over—we who have learned them. For my part, I can write and read English, Swedish, Danish, French, Spanish, Italian, Dutch, and German. Do you think we shall be content to stay here as clerks? No, no. . . . We are learning your trade; we will find out all your customers and your correspondents; we learn your profits and we undersell you. We do not go away. We remain. And presently, instead of an English house, there is a German house in its place, because your young men are so stupid that they will not learn.'

II. Having regard to the importance of these facts, it is well that we should acquaint ourselves with the systems of commercial education that exist in foreign countries, with a view of ascertaining in what respects the training there afforded is better adapted to qualify young men for commercial pursuits than that provided in our own schools.

France.—In France and in nearly all the countries of Europe there is found a system of intermediate and secondary education, which has been organised with reference to the careers which the children are likely subsequently to follow; and there exist, also, numerous special schools, or departments of schools, which are intended to provide a distinctly professional training. The French system of intermediate education has been fully described, and is highly recommended, by the Commissioners in their Report on Technical Instruction. They tell us that in the whole system of French instruction they 'have found nothing, except as regards art teaching, so worthy of attention as these higher elementary schools.'[1] These schools, many of which come under the provisions of the Public Elementary Education Act, and are consequently free, have a technical and commercial department. In the commercial section, the subjects of study include modern languages—English or German, and often both—history, geography, law, political economy, mathematics, practical science, bookkeeping, office practice, and, in some cases, manual training. Examples of such schools are found in Bordeaux, Havre, Amiens, Marseilles, Rheims, Rouen, Lyons, and in other large towns. The *Ecole Martinière* of Lyons is one of the oldest and one of the most interesting of these schools. It is presided over by a council of members, who are nominated by the

[1] Vol. i. p. 84.

Minister of Agriculture and Commerce, on the recommendation of the municipality. The children are admitted to the school between the ages of thirteen and fifteen. From 60 to 75 per cent. of the boys go into commercial houses, and about 25 per cent. take up other industrial pursuits. The *Ecole Professionnelle* of Rheims is a more modern school of the same kind, having a commercial department, with a course of instruction specially adapted to the wants of those children who are likely to be engaged as clerks in merchants' houses, as commercial agents, or travellers. At Vierzon, a school is now being erected, which, when completed, will be equipped with all the newest appliances for improved technical and commercial instruction.

Of French schools specially devoted to commercial training, and having no technical department, the most important are in Paris. The Paris schools are of two grades—middle and higher schools. There are two middle schools—the *Ecole Commerciale*, in the Avenue Troudaine, founded by the Chamber of Commerce in 1863, and the *Institut Commercial*, in the Chaussée d'Antin, founded, in 1884, by a number of merchants, as a public company, with a capital of 8,000*l.* These schools differ somewhat in their methods of instruction, but their general object is to take lads who have received a primary education, and to train them in those subjects which will be useful to them in a mercantile career. Modern

languages, commercial law and geography, mathematics, bookkeeping, and shorthand are the chief subjects of instruction. In the *Institut* more attention is given to the practical details of office work with special reference to foreign trade. 'Different trade operations are illustrated from the books of extinct firms; and the mathematical teacher has ready to his hand coins, weights, and measures of all nations.'[1] The school contains an extensive museum, created by gifts of samples from a large number of firms, which is used to illustrate the lessons on the technology of the raw materials and finished products of commerce.

Besides these schools, which are for the training of boys from thirteen to sixteen years of age, there are in Paris two higher schools, or colleges, which are intended to give a distinctly professional education to young men who have received an ordinary school training in one of the *lycées* of France, as well as to continue the education of a few of those who have passed through one of the middle schools. These higher schools are known as the *École Supérieure de Commerce* and the *École des Hautes Études Commerciales.* The main object of these institutions, but especially of the latter, is to attract to the pursuits of commerce some of the better educated youths, belonging to families of good social position, who are too generally disposed to enter the overstocked ranks

[1] [illegible], 1887, p. 33.

of the so-called learned professions, and to give them a thorough training in the principles and practice of mercantile and banking business. 'In France,' says M. Gustav Roy, 'commerce has too long been regarded as a second-rate calling; it is time to disprove this idea, and to show that the professions of merchant and banker demand as much intelligence as any other.'[1]

The view of the founders of the school was that the study of commercial, equally as of other, subjects may be made the basis of a liberal education. What the *Ecole Centrale* does for engineering and manufacturing industry, the *Ecole des Hautes Etudes Commerciales* is intended to do for mercantile pursuits. This school is situated in a fashionable quarter of Paris, in the Boulevard Malesherbes. The site on which it stands cost over 20,000*l.*, and is now worth considerably more. The building contains spacious apartments for administrative purposes, two lecture theatres, twelve class-rooms or *comptoirs*, ten examination rooms, a mercantile museum, a chemical laboratory, and a good commercial library. It consists of a boarding establishment, as well as of a day school. The school was opened in the year 1881, and the number of students has since then increased from 50 to 128. The fees are high—40*l.* a year for day students, and 112*l.* for boarders; but, in order to enable poor students to enter the school, several exhi-

[1] *Ecoles de Commerce*, Léautey, p. 190.

bitions have been provided by the Government, by the Chamber of Commerce, by the Municipal Council of Paris, by the Bank of France, by a large number of public companies, and by private individuals, amongst whom M. Gustav Roy, late President of the Chamber of Commerce, to whose initiative the school owes much of its success, should be specially mentioned. These facts indicate the estimation in which the education afforded in this school is held by different public bodies, as well as by merchants and bankers in Paris.

As regards the curriculum, I will here only mention that ten hours a week are given to the study of foreign languages, in addition to the time devoted to foreign correspondence, and that English or German, and either Italian, Spanish, or Portuguese, are obligatory. To some of the more important subjects of special instruction reference will be made later on; but the purpose of the ten examination rooms requires some explanation. In this school, as in all the higher schools of France, the periodic examination of the students forms an essential part of the instruction. The *salles d'examen* serve a very different purpose from the examination room of an English college or university, in which the student is employed for three hours in writing answers to printed questions. In France, examinations like laboratory practice or exercises form part of the machinery of instruction. The *salles d'examen* are small compartments, each of which

is just capable of accommodating the examiner and two students. The furniture consists of a black-board, a desk, and two chairs. About once in three weeks each student is separately examined on every subject in which he receives instruction. The examinations take place daily from 4.30 to 6, and every student is expected to attend two or three times a week to answer, orally and in writing, questions on his work, and to submit for inspection and correction his notes of lectures, drawings, accounts, exercises, &c. At the end of each course there are also general examinations, which correspond more nearly with our own, but differ in this respect, that each student draws by lot the questions he is to answer from a large number of questions previously prepared by the examiners. The system of marking, on the result of these examinations, is very complicated.

In Paris, and in nearly all the large towns of France, there are evening courses of instruction in commercial subjects open to persons of either sex. The courses embrace writing, bookkeeping, shorthand, commercial arithmetic, geography, political economy, common law, and modern languages. These classes are supported by contributions from various sources. Some of them have been organised by the Philotechnic Society, founded in 1848 for the purpose of giving gratuitous instruction to adults of both sexes on subjects connected with their industrial occupations. In 1884–5, these classes were attended

by 11,000 students. To obtain a certificate in commerce, a candidate must pass a satisfactory examination in four at least of the following subjects viz., French, some foreign modern language, commercial history and geography, bookkeeping, law, mathematics, political economy.

A somewhat similar society has been founded by the different Masonic Lodges of France. In connection with the *Ecole de Commerce*, in the Avenue Troudaine, free classes have been opened by the Paris Chamber of Commerce, which are attended by about 1,100 students. In addition to these classes, the City of Paris has opened evening classes in commercial subjects for women and young girls. The first of these was opened in 1870, and the success of this experiment induced the Chamber acting in connection with the school authorities of different parishes to establish similar evening courses. Such classes are now held in fifteen *arrondissements*, and are attended by about 700 young women of not less than fourteen years of age. Similar classes have been established for young men, and are held in sixteen centres of Paris. The course of instruction occupies three years, and each student is expected to devote twelve hours per week to his school lessons.

Another important society, established in 1879, to give commercial instruction to young people of both sexes, is the *Union Nationale des Chambres Syndicales*. These classes are held every evening of

the week, and the attendance has increased from 180 students in 1879–80, to 716 in 1885–86. There are also special courses of instruction in bookkeeping only; and an institution has been founded in which boys, after having left school, may keep up their knowledge of English or German by attending evening classes for conversation and correspondence in these languages. It appears that in the school session 1885–6, the number of students entered upon the books of the several societies of Paris, as attending systematic courses of instruction in commercial subjects, was 8,657, of whom 6,179 were men and boys, and 2,478 women and girls. These commercial classes exist not only in Paris, but in all large centres of industry, and are generally well attended.

Schools of commerce in France are not yet placed on the same footing as other high schools, in affording exemption to the students from military service. This is a boon much sought after. At the International Conference on Industrial Education in 1887, held at Bordeaux, one of the resolutions agreed to was, 'that the Minister of War be asked to assimilate the leaving certificates of schools of commerce to those of other schools, in so far as they confer the rights of the voluntary service.'[1] This concession, it is believed, would have the effect of considerably increasing the number of schools of commerce, and of

[1] *Congrès International de Bordeaux. Compte rendu des travaux*, p. 203.

the students attending them; and the fact that it is accorded to similar schools in Germany is urged as an additional reason for seeking it.

Germany.—Germany still stands ahead of all other nations in the excellence of its primary and secondary schools. The well-known *Realschulen*, many of which now comprise ten classes, and are co-ordinate with the *Gymnasia*, afford an education, which is perhaps the best possible general preparation for commercial or trade pursuits. Several of the *Real* schools have a commercial department; but besides these, there are in Germany seventeen special schools of commerce, the leaving certificate of which is recognised as conferring the right of one year's military service; nine middle schools, with a less extended curriculum; and a large number of evening schools, which are attended by clerks, merchants' apprentices, and other persons engaged in mercantile houses. The fees in the ordinary *Realschule* vary from 2*l.* to 4*l.* a year. In the commercial schools the fees are three or four times as much. Few of the commercial schools are as well housed as are the *Real* schools, nor do they possess the same appliances for practical teaching Nevertheless, they are well attended; and the reason assigned is that lads who have received their education in a commercial school are more sought after in commercial houses, and more readily find places, than those coming from an ordinary school The difference in curriculum is not great; but whilst, in

the commercial school, due provision is made for the child's general education, the requirements of the merchant's office are carefully considered in the teaching of all the subjects in the school programme. Thus, additional time is devoted to the study of modern languages, and especial attention is given to instruction in foreign correspondence. The study of mathematics is pursued so far only as is likely to be required by the future merchant, and the pupils are exercised in questions of exchange, arbitrage, and commercial arithmetic generally. The course of study also includes political economy, bookkeeping, and commercial geography. But the instruction is by no means as practical as in many of the French schools. Although the teaching in these schools is excellent of its kind, and evidently much sought after, it would be unsafe to ascribe to the existence of these schools the remarkable industrial success of the German people. Much more is due to the excellence of the primary instruction, to the fact that children remain at school till they have been able to fix in their minds the knowledge they have acquired, to the evening continuation schools in which they build upon early education a sure foundation for higher specialised instruction, to the well-organised system of secondary education, and to the general appreciation and love of learning, which, owing to the existence of these educational agencies, is diffused throughout all grades of society, and has produced habits of thought

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and aptitudes for work which unfortunately are at present wanting among the same classes of our own people.

One of the best known of the Higher Schools of Commerce is the *Handelslehranstalt* of Leipsic. The school is under the direction of a committee of merchants, who themselves contribute to the cost of its maintenance. Since 1880, it has been placed under the general management of the Saxon Government and of the Municipal Council of Leipsic. The school consists of three divisions: (1) the higher division; (2) the professional course; (3) the division of apprentices. Boys are admitted into the higher division at the age of fourteen on the completion of their elementary school course. The fees are 18*l.* a year and 10*s.* entrance fee. The course lasts three years, and it is intended to give a sound general education applicable to commercial purposes. The professional course is open only to those who are provided with a leaving certificate of one of the higher schools, which exempts the pupil from two of the three years' obligatory military service. The course of instruction occupies one year only, and is purely of a commercial character. The third division consists of a continuation school, which is intended for clerks employed in commercial houses in the City. In the regular three years' course of instruction, which is given in the higher division of the Institute, the pupils receive a good secondary education, based on instruction in

those subjects which are likely to prove useful to them in their subsequent work. The programme includes modern languages, mathematics, commercial arithmetic, science, technology, geography, history, commercial law and office work, bookkeeping, political economy, writing, drawing, and gymnastics. The lessons in technology embrace the description of some of the principal machines used in spinning, weaving, paper-making, &c.; the office work consists of lessons in preparing commercial documents and commercial correspondence; and about fourteen hours per week are devoted to the study of modern languages. The course of instruction for apprentices or clerks occupies ten hours a week. The lessons are from seven till nine in the morning, or from two till four in the afternoon, according to the convenience of the employers. These courses are given in addition to the ordinary continuation classes which are established and maintained by the Municipal Council, and are found in nearly all the principal cities of Germany.

With the view of meeting the requirements of young men who desire to receive instruction on commercial subjects, some of the Polytechnic schools of Germany have arranged courses of lectures, which are mainly intended for those who are seeking places under Government in the customs or excise offices, but are followed by other students, who have received their early education at a *Gymnasium* or *Realschule*,

and whose circumstances enable them to spend a year or two at college before commencing business.

In Berlin, a school of Oriental languages was opened in October 1887, as a special department of the university of the city. The school is maintained at an annual cost to the State of a sum not exceeding 3,600*l.*, a vote of 2,000*l.* having been made for the equipment. The teaching is gratuitous, and exhibitions amounting to 450*l.* a year are awarded to needy students. The languages taught are Chinese, Japanese, Hindostani, Arabic, Persian, Turkish, and Suaheli. The instruction includes descriptions of the several countries in which these languages are spoken, lectures on the religion, manners, and customs of the people, exercises in grammar, in reading, writing, and speaking. The chief instructor in each language is a German who has resided abroad, and he is assisted by one or two natives, who help the students with their exercises. When vacancies occur in the public service, preference is given to students who have completed their course in this school.

Austria-Hungary.—In Austria-Hungary there are nine high schools of commerce, eleven intermediate schools, and forty-two schools intended principally for clerks. There is nothing that calls for special notice in the subjects of instruction in these schools. The course of study is very similar to that in the corresponding schools of Germany. The most important of the high schools is in Vienna, and is known

as the *Handels-Akademie*. It gives two courses of instruction, the one occupying three years and the other two years. The subjects of instruction are nearly the same as those of the French high schools. The methods are different. Great attention is given to the analysis of trade products with the view of detecting adulteration. The school is attended by 700 students, who are taught by 34 professors and instructors. The fees for paying students are 16*l.* a year, and about 150 students are admitted with exhibitions covering the whole or part of the cost of instruction. In Germany proper, there is no school exactly corresponding with the *Handels-Akademie* of Vienna, which has more the character of a commercial university than any other institution I have visited. 'The aim of the present Director, Herr Geheimrath Dr. Sonndorfer, has been to make the training suitable not merely for clerks and managers and the like, but more especially for the principals and heads of business concerns, for future bankers, merchants, manufacturers, and political economists of Austria. . . . His object has been, further, not only to train the minds of his pupils, but also to form their characters, and he believes it can be done by the mercantile subjects, with a due admixture of mathematics and modern languages, equally as well as by the purely Gymnasial or Real school courses.'[1]

During the winter months the academy is open in

[1] *Report to Associated Chambers of Commerce*, p. 27.

the evening for the instruction of clerks and others engaged in business during the day.

Italy. -- In Italy, the subject of commercial education is receiving careful attention. The system of bifurcation commences immediately after a child has left the elementary school. Those intended for industrial pursuits pass on to the so-called technical school (*scuola tecnica*), and thence to the technical institute. Others pass through the corresponding classical schools to the university. The technical institute corresponds to some extent with the higher *Real* schools of Germany ; but each institute contains three or more separate departments, in which the instruction is specialised with a view to different branches of industry.

These institutions, located, for the most part, in ancient convents or monasteries, are found in sixty-five of the principal towns of Italy. They are generally well provided with collections of objects illustrating natural history, with models of construction in engineering, with specimens of raw and manufactured products, with good chemical laboratories and drawing offices. They comprise four or five departments or faculties, one of which is generally devoted to agriculture and another to commerce. With the specially technical departments I am not now concerned, but the well-arranged collections of natural objects with which these schools or colleges are furnished are most serviceable in illustrating the courses of instruction

in the commercial section. In this section, the study of natural history, chemistry, physics, and mathematics occupies a large part of the students' time; and from twelve to fourteen hours a week are devoted to foreign languages. There is nothing in the programme of these schools corresponding to the *Bureau Commercial* of the schools of France and Belgium. The several subjects of instruction are taught by professors of great ability and reputation, and embrace those of a good modern school. In a country where the commerce consists, to a great extent, of transactions in agricultural products, the study of biology, especially in its application to those products, becomes an important part of the education of the future merchant. Special attention is, therefore, given to the study of organisms affecting the growth of those plants and animals which enter into the commerce of the nation. All the ills to which the vine and cereals, the silkworm and the bee, are liable are minutely studied; and in this way, the commercial student not only acquires a large amount of information which will be useful to him in his subsequent career; but, what is more important, his mind is cultivated and his faculties are developed by studies which are scientifically pursued, and which have direct reference to his work in life.

But the Italians themselves are not altogether satisfied with their present system, and contemplate making some important changes, with the view of

better defining the instruction given in their several schools. A professor of the institute at Udine complained to me, when I visited the school in the year 1883, of the want of efficient inspection, and of the tendency of the school teaching to become stereotyped, from the absence of the necessary contact of the professors with the life and trade that is going on outside the school. Others have complained that the technical institute attempts too much, and is too economically managed. It serves as a finishing school for those who on leaving it go at once into mercantile or manufacturing pursuits, and as an intermediate school for those who are preparing for higher technical education. It is said to fail between these two objects. Moreover, a great part of the instruction is common to all departments, and is not equally well adapted to the students of each section. The future agriculturist does not want the same mathematical teaching as the future engineer; the professor must go too far for one or not far enough for the other. These complaints, arising from the difficulty of adapting instruction to every one's needs, are heard in other countries also, and have reference to other schools which are not sufficiently specialised. Then, again, it is said that these institutions do not attract the best pupils, and that many of those who subsequently elect industrial, as distinguished from literary pursuits, are educated in the classical schools; and, further, that the instruction of a technical insti-

tution is deficient in those humanistic elements, the study of which is necessary to the cultivated man, who is to organise or rule other men, be his special calling what it may.

In Italy, as in other countries, many of the young men who enter commercial life have received their previous education in an ordinary classical school. This is, of course, more frequently the case with sons of well-to-do parents. As children, their careers have not been definitely settled, and their parents have sent them to schools, where they receive the training which enables them to enter the so-called liberal professions. Their future occupation having been determined, it is found necessary to give them some special training before they can enter a merchant's office, and to provide this training the higher schools of commerce have been established. But not only for students of this class has the want of such establishments been felt. The fact already referred to—that in the technical institute many of the courses are common to the several departments, and are followed by all the students—prevents that particular extension and specialisation of the studies, which is thought desirable for those about to enter upon a commercial career.

The high schools of commerce provide this special instruction for the mercantile profession. One of the best of these schools is that recently opened in Genoa, which has been founded on the model of the

well-known, but somewhat antiquated, school at Venice, with a curriculum following more closely that of the high schools of Paris. When I visited this school, in April 1887, only the first year's course of study had been arranged; but I was struck with the thoroughness with which the subject of geography was being taught, with the attention given to the practice of map-drawing, and with the carefully selected library of works on the history of commerce, on mercantile law and statistics. In a few years the school will take rank with some of the best schools in Europe.

Belgium.—This country possesses numerous middle schools, the object of which is to prepare youths for commercial pursuits. The fee for instruction in these schools is 2*l.* 18*s.* per annum. The fact that the children of the middle classes are destined, for the most part, to earn their livelihood in trade or commerce, is recognised in the general scheme of intermediate education adopted in Belgium, and the course of school studies is arranged accordingly. The youths who are trained in these schools receive that kind of instruction which can be made at once available in their several subsequent occupations. Besides these schools, in which the bulk of the population, whose education is extended beyond the limits of primary instruction, receive their training, there has existed for some years at Antwerp a commercial academy, in which the principals of a large number

of Belgian firms have obtained their business education. This academy is one of the oldest of the commercial schools of Europe. It sends out annually a number of young men proficient in foreign languages, well trained in commercial science, and with an intimate knowledge of the ordinary details of office work. The school is provided with an excellent museum, in which are found well-arranged specimens of all kinds of raw materials and manufactured products. By its system of travelling scholarships the school has been able to form centres of trade in different parts of the world, and the value of the education afforded in the school is fully attested by the readiness with which those who obtain the leaving certificate are enabled to find places in merchants' offices. The reputation of the school is such that for many years it has been attended by a large proportion of foreign students. In the session 1874–75 there were 134 students, of whom 81 were Belgians and 51 foreigners, and in the session 1886–87 there were 134 students, of whom 55 were foreigners. The cost of the education is 4*l.* a year for the preparatory class, 8*l.* for the first year's course, and 10*l.* for the second year's course. The fee for any special course is 24*s.* The academy is supported by the students' fees, by a grant of 1,800*l.* a year from the State, and of 450*l.* from the city. The State and the different provinces in Belgium provide a large number of exhibitions tenable at the academy. These exhibitions vary in

value from 10*l.* to 32*l.* a year. They are renewable after the first year, and are given to those students only who pass the entrance examination. Such exhibitions are given by the provinces of Antwerp, Brabant, Hainaut, Liége. The academy is distinctly the central school for the whole country.

III. There are several subjects in the curriculum of foreign schools of commerce which require special notice. As has been already pointed out, a large amount of time is devoted to the study of foreign languages, and the pupils are exercised in reading and writing the forms of documents which they would be likely to meet with in the mercantile office. This system of teaching foreign languages differs essentially from that adopted in our own schools. A boy may leave school, where he has learned for some time French or German, and may be capable of reading, with or without the help of a dictionary, portions of Racine or Molière, of Schiller or of Goethe. But when he finds himself in a commercial office, and has a French or German business letter placed before him, he discovers that his previous knowledge helps him very little to understand it, and that he is quite unable to reply to it. Even the handwriting presents an initial and not inconsiderable difficulty, and he is wholly unfamiliar with the technical expressions the letter contains. The employer's confidence in the youth's knowledge of foreign languages is thus shaken, and

the letter is handed over to the foreign correspondence clerk, who, owing to the special instruction he has received in a commercial school, enters the office with a knowledge and experience which he is able at once to utilise.

Practice in corresponding in foreign languages is afforded in all schools of commerce abroad; but one of the distinguishing characteristics of the high schools of France and Belgium, and to a less extent of the academy at Vienna, is the instruction in office practice, which goes by the name of the 'Bureau Commercial' or 'Muster-Comptoir.' By the 'Bureau Commercial' is meant practice in carrying on between different classes, or *comptoirs*, mercantile transactions, similar, so far as circumstances permit, to those carried on between mercantile firms in different parts of the world. For example, a student in the German *comptoir* is told to suppose himself at Hamburg, and is required to purchase a certain quantity of cotton, say from New York. He writes a letter in German to his supposed agent in New York, asking for particulars as to the cost of the cotton required. This letter, before being sent, is submitted to, and corrected by, the German professor. He receives from another student a reply written in English, in which the particulars of prime cost, package, freight, duty, &c., are expressed in the coinage and weights of the United States. This reply the student translates into French, and his translation is revised by his instructor. The trans-

action is then completed by forwarding a bill, which is duly made out by the student. As far as possible, all the incidents of the transaction are brought under the notice of the student, and all the office work connected with it is done in the different *comptoirs* of the school. It is contended that, by introducing a certain appearance of reality into the correspondence connected with a commercial transaction, the student's intelligence is exercised, and habits of care and accuracy are formed; and that a facility is acquired in corresponding in foreign languages which could not be otherwise obtained. It is evident that, in a course of exercises and correspondence extending over a year, and dealing with different kinds of merchandise, the student must acquire the ability to read and write foreign business letters, as well as an acquaintance with foreign systems of weights, measures, and coinage, and with arithmetical problems in which these occur. But whether such practical knowledge could be better acquired in a merchant's or banker's office, and whether the time thus occupied at school or college might be more usefully employed in the study of the ordinary subjects of instruction, is an educational question which, without further experience of the working of the system, I find it difficult to answer. The evidence I have been able to gather from masters and merchants abroad leads me to believe that this special instruction is highly valued, and the fact that it has been in-

troduced into the new school of the Chamber of Commerce of Paris, and that it is about to be extended to the more recently opened school of the same kind at Genoa, would seem to show that those who have had experience of the working of the system regard this instruction as a useful introduction into commercial life. On this point, however, as on many others, doctors differ. The director of the Antwerp academy informed me that students who had completed the course of *Bureau Commercial* were much sought after by merchants, who attached the highest value to the instruction. On the other hand, we are told that the director of the Vienna school is of opinion that the system, 'especially for large numbers of pupils, is superficial, and tends to no really useful results.' It is, however, still retained in a somewhat modified form at Vienna, although confined to the work of the last year. In Prague, the French system prevails. What is evidently wanted is to inform young men as to the kind of correspondence which is carried on in commercial houses, and to teach them to conduct the correspondence in foreign languages. Whether this can be best effected by the method adopted in Paris, Antwerp, Prague, or Vienna must for the present be left undecided.

There is another subject of instruction common to all schools of commerce, of the value of which there can be no doubt—viz., commercial geography. It is a wide subject the study of which, if properly pur-

sued, might by itself constitute a liberal education. It implies even more than geography, as understood by Professor Geikie, who, regarding it as the study of the earth 'as the dwelling-place of man,' gathers up into it all the sciences which are subservient to man's uses; for commercial geography may be considered as the study of the earth—first, in its relation to man generally, and secondly, in its relation to the commercial pursuits of man. Such a study involves a knowledge of the elements of physical, political, and ethnological science, and should dominate the greater part of the general science instruction which a student would receive in a commercial school. It includes, among other things, a knowledge of the natural products of different countries, and more especially of those which are of common use in commerce.

In this country, the subject of commercial geography has never yet received the attention which its importance demands. In a letter to the late Lord Iddesleigh, appended to the Report of the Commissioners on the Depression of Trade, Commander Cameron specifies the various heads under which commercial geography should be studied, and shows how essential is a knowledge of the subject to those engaged in mercantile business. 'In Germany,' he says, 'there are no less than fifty-one publications devoted to the cause of commercial geography, and there are many societies specially

founded for its study.'[1] These societies have agents in various parts of the world, who conduct all sorts of inquiries. They find out not only what goods are required in various markets, but also the precise mode of packing to suit the idiosyncrasies of buyers. After referring to a number of questions which might be elucidated by a knowledge of commercial geography, Commander Cameron further states, 'The extension of our commerce and its maintenance on a sound and remunerative basis depends greatly upon the knowledge of commercial geography with which it is conducted.'[2] And the Commissioners, in their final Report, say, 'In connection with the development of new markets for our goods, we desire to call special attention to the important subject of commercial geography.'[3] They might have added that it is carefully taught in every foreign school of commerce, and that thousands of youths are annually sent out from these schools with a respectable knowledge of the subject, and with the aptitude for further knowledge, which travelling, and the reading of consular reports and the journals of geographical and trade societies, enable them to obtain. In England, the Society of Arts has arranged for examinations in commercial geography, and in other subjects useful to the mercantile student; but of late no examination has been held in commercial geography, owing to the fact that *less than twenty-five candidates, not from one*

[1] *Commissioners' Report*, p. 71. [2] *Ibid.* p. 74. [3] *Ibid.* 101\.

centre only, but from the entire kingdom, have presented themselves. Nothing, perhaps, could show more strongly the total neglect of commercial education in this country.

Closely connected with the teaching of commercial geography is the instruction given in all foreign schools in the technology of merchandise (*étude des marchandises, Waarenkunde*). The teaching of this subject is illustrated by reference to specimens of raw and manufactured products exhibited in the museum which is a part of the equipment of nearly every foreign school. The museum is generally furnished by gifts from the Chamber of Commerce, and from merchants resident in the city. The specimens are carefully selected with a view to their educational value. They generally comprise samples of some of the principal raw materials used in commerce in their natural state, and as met with in trade. These are carefully classified and arranged. The museum also contains various substances, principally local, as altered by different processes of manufacture; diagrams and models illustrating the diseases to which substances of vegetable and animal growth are liable; specimens showing the effect of adulteration, and the differences between genuine goods and their counterfeits, and a variety of other things too numerous to mention. In these museums, objects having reference to the trade and commerce of the district occupy a prominent position. In all the newest schools the museum

communicates with the lecture-room, in which these commercial 'object lessons' are given; and every opportunity is afforded to the students, by the actual handling and tasting of the specimens, by the chemical analysis of some of them, and by the microscopic examination of others, and by general descriptive lectures, of becoming practically acquainted with many of the principal mercantile commodities.

It is impossible that a student, during his school course, or, indeed, during life, should obtain a complete knowledge of the various objects found in such a museum. But just as the geologist, *quâ* geologist, is satisfied to know the general characteristics of the minerals of which any rock is composed, and the organic remains which are found therein, without possessing the intimate knowledge of these matters which the chemist or biologist should possess, so the commercial student may be satisfied to know such of the properties of the substances he meets with as are essential to his being able to distinguish them as commercial products, without necessarily possessing that deeper and more detailed knowledge which the specialist would seek to obtain. Professor Geikie rightly attaches much importance to this study in the teaching of ordinary geography. In his little book on 'The Teaching of Geography' he says: 'If there are any special industries for which the school district is remarkable, these will, of course, receive due attention. In a village school, situated

in a rural and agricultural district, for instance, the operations of farming will be fully considered; in a mining district all that can be intelligibly presented regarding mines and miners will be given with every available illustration. Among spinning mills the history of weaving will be readily appreciated; and as weaving and spinning are of such universal importance they should be fully explained, with such samples of works and drawings of machinery as will give an adequate conception of the nature of these arts.' If it is desirable that the teaching of geography should be so illustrated in the lessons given in ordinary schools, how much more important is it that the commercial student should have access to a properly equipped museum, and that he should learn at school something of the properties of the materials he is likely to meet with in his mercantile career? Such museums are necessarily of slow growth. Those in the high schools of Vienna and Antwerp[1] are among the best equipped. The museum of the new school at Paris is full of specimens, and is carefully arranged; and the commercial departments of the district technical institutes of

[1] Besides the school museum connected with the *Institut*, a commercial museum on a much larger scale [illegible] Antwerp, and was [illegible] on [illegible] 4, 1887. Several [illegible] in Europe [illegible] [illegible] &c.

Italy contain museums which are full of objects illustrating all the principal branches of trade carried on in home and foreign markets.

The study of modern languages and of commercial geography, including the technology of merchandise and the elements of science underlying it, constitute the groundwork of a commercial education. Of course there are other subjects which a pupil would need to learn. The importance of an adequate knowledge of arithmetic and of mathematics cannot be over-stated; and, under arithmetic, should be included the principles of bookkeeping, and practice in the solution of mercantile problems. Good handwriting is a matter which should receive more attention than is generally given to it in ordinary schools. In the higher schools, there are other subjects, such as mercantile law, the history of commerce, and the principles of political economy, which should be taught, in order that the student may gain that wide and comprehensive knowledge of his business which gives to professional studies a value as a means of intellectual discipline and culture.

Another important feature of the instruction is the periodic visits of the students, under charge of their professors, to various industrial works. These visits are sometimes extended to factories and business houses at a distance, and occupy some days. At the *École Supérieure de Commerce* of Havre, these excursions form a very important part of the instruc-

tion. In 1883, under the conduct of the director and of the professor of merchandise, eighteen of the students visited Hamburg and Lübeck. In 1884, two excursions were made, the first to the principal centres of industry in Belgium; the second, by first year's students, to Hamburg and Bremen. Some of the high schools of commerce have travelling scholarships, tenable for one, two, and three years, which enable the student to reside abroad, to perfect himself in foreign languages, and to learn foreign methods of conducting business. The Belgian Government, besides paying three-fourths of the cost of the maintenance of the high school at Antwerp, makes an annual grant of 1,800*l.* for travelling scholarships, which are given, under certain conditions, to the most distinguished former students who desire to spend some years out of Europe. Each scholarship is of the annual value of between 200*l.* and 300*l.*; and one of the special objects of these scholarships is to encourage the establishment of commercial houses in colonial and other settlements. The result of this expenditure is said to have been most satisfactory, as shown by the establishment by old students of the Antwerp Academy of flourishing commercial houses in Brazil, Mexico, Melbourne, Sydney, Calcutta, Chicago, and other places. To award such scholarships to students who had not previously acquired a knowledge of foreign languages, and an acquaintance with the commercial geography of the country they intend

to visit, would be of little use. 'He that travelleth into a country before he hath some entrance into the language, goeth to school, and not to travel,' Bacon tells us; and what is true of the language is almost equally true, so far as the commercial traveller is concerned, of the geography of the country. Of the value of such scholarships, when awarded to those whose minds are previously prepared to take advantage of the opportunities they offer of opening up new commercial relations, there can be, I think, very little doubt.

This brief notice of the facilities for commercial education enjoyed by the principal Continental nations, and of the methods of instruction adopted in their schools, cannot fail to impress us with the fact that Englishmen are seriously handicapped in the struggle for their fair share of the commerce of the world.

IV. In considering what is needful to place us more nearly on a level than we are at present with our Continental rivals in the matter of mercantile training, we should, I think, turn our attention rather to the improvement and adaptation of our existing educational machinery than to the creation of new schools exactly corresponding with any of the different types of foreign schools of commerce. Every encouragement might be given to private enterprise, to the action of trade societies, or to chambers

of commerce, in the establishment of a limited number of schools of this kind, which, if adequately equipped and properly conducted, might be nearly self-supporting. But, having regard to the fact that an overwhelming majority of the children who are being educated in our elementary and higher schools are destined for employment in commercial or productive industry, what is needed is not so much the establishment of special schools as the adaptation of our whole system of education to their wants and requirements.

The demands of commerce alone do not necessitate any special alterations in our system of elementary education. As has been pointed out by numerous witnesses who have been heard before the Royal Commission on the Working of the Education Acts, our system of elementary education requires modification, but not specially with a view to the requirements of those who are to be engaged in commerce. The fact that nearly all children educated in our primary schools are likely to begin life by occupying humble positions in factories, shops, or mercantile houses, should be taken into consideration in framing a curriculum of studies for our elementary schools. It is the neglect of this consideration which has led to the demand for the introduction into these schools of teaching that is at once more useful and more practical.

There is, however, one matter which affects our

primary instruction, whilst it has an important bearing on our commerce generally, which ought not to be omitted from the consideration of the question of commercial education, viz. the advantage that would be derived from the general use of a decimal system of coins, weights, and measures. I think that the desirability of such a change ought to be impressed upon our Government in connection with the present demand for improved facilities for commercial instruction. No very accurate estimate can be formed of the time occupied in our elementary schools in teaching children our unscientific method of estimating measures, weights, and values. It is, however, considerable. In this respect our children are at a great disadvantage compared with the children of other countries. Their progress in arithmetic is retarded, and the time spent in learning by heart their 'tables' might be employed in the real work of education. I should say that the substitution of a system of decimal units for our own would result in a saving of time in which a child might acquire a useful elementary knowledge of some foreign language. Perhaps more important than a decimal coinage is the adoption in commerce of the system of weights and measures employed in all scientific investigations, and now in general use throughout Europe. The assimilation of our own to foreign systems would be a great benefit to us. Not only would all commercial calculations in our home trade be greatly simplified,

but in our dealings with foreign countries the margin of profit, which for reasons already adduced is growing narrower and narrower, could be more exactly determined, and profitable transactions might be undertaken which, from want of precise knowledge, are often neglected as being of too doubtful advantage. Trade has become too exact a science to be profitably carried on by those who are not quite certain of the commercial value of their vulgar fractions.

Whilst it is not desirable for the purposes of commerce that primary instruction should be specialised, it is most important that it should be continued until the child has obtained a firm grip of the subjects he is taught. To this end, leisurely and systematic study is indispensable, and this cannot be hoped for unless children are required to remain at school till the age of fourteen.

On leaving the elementary school a great majority of the children go at once into the office, the factory, or shop. A few continue their education in some higher school. For both these classes a special training is desirable if they are to be occupied in commercial pursuits. For those who leave school at an early age, 'continuation classes' are indispensable, if the greater part of the nation's outlay on elementary education is not to be absolutely lost. I have known numerous instances in which lads of eighteen and twenty years of age have been unable to avail themselves of the instruction given in the

technical and science classes now established, in consequence of their having forgotten the little they had learnt in school. In my official capacity I have been asked whether oral examinations might not be substituted for written examinations, in consequence of the difficulty experienced by the candidates of expressing themselves in written language. Among the many excellent features of the German system of education, none is to be more commended than the regulation which compels children who leave school at an early age to attend 'continuation classes' till the age of sixteen. In this country, where no compulsion exists, every encouragement should be afforded to apprentices in business houses to attend such classes.

The organisation in all large towns of evening classes, with a well-arranged programme of studies extending over three years, is a necessary part of any system of commercial education. If our clerks are to hold their own against the competition of foreign clerks, opportunities must be afforded to them of making up, by evening instruction, for the deficiencies of their early education. In order that such classes may be established, commercial instruction must be placed on a similar footing to the teaching of science and technology. So long as the system of payment on results continues in force, it should be extended to the teaching of commercial subjects. Until the sense of local responsibility has been further developed, and

the advantages of local self-government are more fully appreciated, municipal authorities cannot be expected, even if permissive powers are conferred on them, to defray the entire cost of this additional instruction. The State must step in and help. Moreover, for some time, at least, the general guidance and control of some central body, which understands and pays due regard to local requirements, would be advantageous; and this guidance and control could best be secured by a system of examination and inspection, and by some modified system of payment by results. It is well known that, partly owing to the absence of such system, the Society of Arts failed to organise classes in technology, or to attract candidates, except in very small numbers, to its examinations; and the inability to give pecuniary assistance has undoubtedly been one of the causes of the paucity of candidates for its commercial examinations.

But, in order that the mass of the middle classes may be properly trained for commercial, and, indeed, for industrial pursuits generally, our entire secondary education needs to be remodelled, and for the first time properly organised. It is the defects of our secondary education which are most affecting the trade interests of the country. And by secondary education I here mean all education between primary and university teaching. It includes the instruction given in the higher elementary, the 'middle,' and the endowed public schools. The technical and com-

mercial education which the country needs cannot be provided until the teaching in our secondary schools has been reformed. We are constantly pointing to Germany, as a country, where higher education is more generally appreciated, where scientific knowledge is more widely diffused, where the cultivated classes are more numerous than they are in England. The explanation of the difference lies in the better system of secondary education in that country. Our higher elementary schools have yet to be created. Our middle schools are, for the most part, parodies of our higher secondary schools, and these latter provide a training wholly unadapted to the existing requirements of the majority of the people.

It is not only—nor, indeed, principally—because Germany possesses numerous schools of commerce that she sends forth hosts of well-trained young men to occupy the best posts in foreign commercial houses, and to establish trading stations in all parts of the globe. It is mainly because her system of secondary education is adapted to the wants of the people. Her sons are trained to observe and to think, and what they learn they can utilise in after life. This is not so with us. What we most want are good higher elementary or middle trade schools, and a systematic organisation of our secondary education.

The higher elementary schools should be similar in many respects to the excellent schools which are to be found in Paris and in the principal manufactur-

ing towns of France. These schools should have a technical and a commercial side. To the course of study to be pursued on the technical side I shall refer in a later chapter of this book. The commercial side might adopt a curriculum similar to that of the schools of commerce in Germany, and especially in Bavaria; but many of the subjects might be studied by the pupils of the technical as well as of the commercial side of the school. This is especially the case with English literature, the value of which, as a subject of school instruction, I am glad to see, has not been overlooked in the regulations of the Oxford and Cambridge Board for commercial certificates. Much of the time now spent in teaching disputed grammatical distinctions and antiquated forms of English words might with advantage be devoted to the study of the masters of English, as a preparation for the practice of English composition, and as a means of developing the imagination and of stimulating an interest in good books. The claims of literature to occupy a prominent place in our education have been well expressed by Mr John Morley, who tells us that it 'furnishes the ideas which guide the conduct and mould the character, and it is upon conduct and character that the future of the nation will depend.'

The curriculum of these schools on the commercial side should embrace the following subjects:— English including literature and history, foreign lan-

guages, commercial geography and the technology of merchandise, elementary science, arithmetic, including bookkeeping, mathematics, writing, and drawing.

Many of our existing middle-class schools, if they would give up the profitless teaching of the rudiments of Latin grammar, might provide a commercial and technical training adapted to the children of small shopkeepers, of clerks, foremen, teachers, and others, most of whom would be likely to be afterwards engaged in mercantile or manufacturing business. The fees in these schools should be low, and a large number of children, too poor to pay such fees, should be admitted by exhibitions from the public elementary schools, and should thus be enabled to pursue their education on the technical or commercial side, according as their tastes or chances of subsequent employment might suggest. By such a system, a boy's life's occupation would be, to some extent, determined for him during his school course, and his education would serve as a fitting preparation for his future work.

The curriculum I have indicated for the commercial side of these intermediate schools would, with some slight modifications, be equally serviceable for girls, who, it may be expected, will be every day more generally employed in public offices, and in certain departments of mercantile houses.[1]

[1] A [illegible] middle school [illegible] schemes prepared by the Charity Commissioners [illegible]

But besides the creation of such schools, other changes are needed for the satisfactory organisation of our secondary education. The course of study in many of our public endowed schools, including our first grade schools, needs to be modified, that it may be better adapted to the requirements of the several careers in which the pupils of these schools are likely to be engaged.

In the organisation of our secondary education, our aim should be to prevent, as far as possible, any sudden break between the training of the school and the training we obtain in the active business of life. This discontinuity in our education can only be avoided by teaching in school those subjects the knowledge of which a man or woman may utilise in after life. Now, it may be very desirable, as a preparation for certain careers, that children should commence at nine or ten years of age to write Latin and Greek verses, and that they should spend from ten to sixteen hours a week in the endeavour to read and write two ancient languages, which they will never require to write or speak, and the literature of which is well translated. But even if such an education is the best possible training — and I do not deny that it is so — for a small and limited number of children, it does not follow that all children, how diverse soever their tastes and future careers, should be passed through the same mill. Of course, it is said, that the classics are taught not for their use, but for the

intellectual discipline which their study yields, and for the advantage, which is very doubtful, of understanding the derivation of scientific terms. But, without entering upon the arguments for and against the study of Latin and Greek, we may assume that the varied occupations in which men are now engaged, requiring for their successful pursuit highly trained minds, demand greater diversity of preparatory studies than was necessary when the range of learned professions was much more limited. Engineering in all its branches, manufacturing industry, and commerce now claim to be regarded as callings or professions, and need as broad and liberal an education as theology, medicine, or law.

What we want, therefore, are good secondary schools, which offer a wide choice of studies to the pupils. For those who are to be engaged in practical pursuits, the necessary linguistic training should be obtained through the medium of foreign languages, which, in the case of students preparing for commercial life, should form the backbone of their studies. For those who show a taste for technical pursuits, or are likely to be employed in engineering or manufacturing industry, physical science should form the principal subject of instruction; whilst the classical languages might continue to occupy the major part of the time of those pupils who exhibit any literary aptitude. We require, therefore, schools consisting of three departments—(*a*) classical, (*b*)

science, and (*c*) modern languages. In each of these departments the curriculum would embrace several other subjects in addition to the principal subject; but neither in the science, nor in the modern languages department, would the classics form a necessary part of the instruction. The omission of classics would leave time, which does not now exist where even Latin only is taught, for the practical study of physical and chemical science, without neglecting mathematics, literature, and other subjects, which are necessary parts of a liberal education.

If our secondary schools were thus remodelled, the necessity for separate commercial schools, such as exist in France and Germany, would not be so keenly felt as it is at present. Our clerks and others, who occupy the lower rungs of the commercial ladder would find a fitting training in the elementary school, supplemented by evening instruction; or on the commercial side of the higher elementary or middle school, supplemented by advanced lessons in evening classes. Others, whose means and social position enable them to hope to obtain higher places, to become representatives abroad of mercantile houses, or to occupy the continually increasingly important post of foreign consul, would find, in the modern language department of a good secondary school, the best preparatory training for a commercial career.

What is needed to give completeness to the scheme I have sketched out are places of higher

instruction corresponding, to some extent, to the *Ecole des Hautes Etudes Commerciales* of Paris, to the *Handels-Akademie* of Vienna, and to the new school of Genoa. These establishments are all intended to give the necessary professional training to young persons who have previously received only a general education. Having regard to existing circumstances, it would seem well that these higher commercial schools should form special departments of our metropolitan and provincial colleges. It would be desirable that a distinct course of instruction should be arranged for the students of this department, occupying at least two years, and embracing most of the subjects taught in the corresponding foreign schools. Students should be admitted to this course on passing an entrance examination, and a diploma should be awarded to those who satisfactorily complete it.

To place this higher commercial training within reach of the poorer classes, leaving scholarships tenable at one of these colleges should be established in connection with the higher elementary and middle schools to which I have referred. It is often said that scholarships do not benefit the poor, but only those who are in easier circumstances. This is frequently the case when the scholarship is given on the results of a competitive examination open to all comers. But whilst scholarships of this kind are useful in raising the tone and character of the instruction of the school or college in which they are ten-

able, it is desirable to attach leaving scholarships to particular schools, for the benefit of students who can pass the entrance examination of the institution in which they may wish to pursue their education, but whose circumstances are such as not to enable them to compete on equal terms with better-off candidates. If some of these scholarships were made available for children from the public elementary schools, who had gone on to the middle schools, another gate would be found through which the children of the poor might enter the university.

If these changes were introduced into our educational system, facilities for commercial education would be afforded (*a*) on the commercial side of the higher elementary or middle school; (*b*) in the evening commercial classes; (*c*) on the modern language side of the endowed public school; (*d*) in the commercial department of the local university college; and adequate training would be thus provided for the various grades and classes of persons who are engaged in the conduct of commercial affairs.

In the organisation of courses of instruction in some of the specially commercial subjects, which should be taught in most of the schools above referred to, the Imperial Institute might render valuable assistance. This Institute might do for commercial education what the projected Science Museum, with its collection of instruments and apparatus, was in-

tended to do for science teaching. If it fulfils the expectations of its promoters, it will be the centre from which the newest knowledge on commercial matters will radiate. In his address on the work of the Imperial Institute, delivered in April 1887 at the Royal Institution, Sir Frederick Abel said: 'It will be well within the scope of the Imperial Institute, as an organisation for the advancement of industry and commerce, to promote a systematic improvement and organisation of commercial education;' and he indicated various ways in which its resources might be made available for the purpose. In helping to systematise and to disseminate the varied and constantly growing information which constitutes commercial geography, it will perform a useful function. The teachers of this important branch of knowledge have yet to be formed. In the Imperial Institute it is expected that they will have the opportunity of receiving some training. The Institute will contain rooms in which the newest maps of different countries may be studied, and libraries of reference on all subjects connected with the statistics and progress of trade and the history of commerce. Digests will be made and circulated of the valuable consular reports now periodically published; and gratuitous lectures might be given on the various aspects of commercial geography, and on the best methods of teaching it.

In the organisation of school museums further

assistance may be looked for from the Institute. Such museums, we have seen, are an essential part of the equipment of every foreign commercial school, or department of school. The Imperial Institute will contain numerous well-arranged specimens of the raw and manufactured products of different provinces and districts. From these specimens typical examples of school museums, adapted to different localities and different grades of schools, might be provided, so that the teacher or school manager might see at a glance the kind of museum he ought to endeavour to secure. The conferences to be held at the Institute on mercantile subjects will have their value for the commercial teacher as well as for the commercial agent. Indeed, the Institute, so far as commercial knowledge is concerned, may be expected to serve the purpose of a world in miniature, in which those engaged in education may learn something of the conditions and circumstances under which trade is carried on in different countries, without the trouble and expense of travelling through the world itself.

I have now shown in what ways our existing educational machinery should be modified to meet the new demands on it. A slavish imitation of Continental systems of instruction is not recommended, for the educational system of any country is a part of its social and political constitution; but much may be learnt from the study of foreign schools

of commerce, which cannot fail to be of use to us in our endeavours to adapt our own school teaching to the modern requirements of commercial industry.

What is most needed is better organisation. Very few countries possess more efficient educational agencies than England, and nowhere, perhaps, are they worse organised. Our elementary education is systematically developed; so, too, are our evening classes in science, art, and technology. All else is in a chaotic condition. The remedy for this state of things has been pointed out by more than one authority on educational matters. It consists in the organisation of an Educational Department, presided over by a Minister of Education, whose jurisdiction shall extend to all grades of education, from the primary school to the university. The institution of such an office need not in any way interfere with the valuable assistance which education must always receive from private efforts in the initiation and management of new movements. On the contrary, such movements would, to the extent only that would be necessary and no further, receive State aid. Abroad, it is common to find organisations for providing technical and commercial education, although locally controlled, receiving regular subventions from the State. Indeed, Government supervision may prove an advantage, if properly directed, in securing a high standard of efficiency in educational institutions, and in drawing public attention to the work they are doing. If

such an office were created, the Minister would have cognizance of elementary, secondary, and university education, and many of the anomalies that now exist would disappear, and much uselessly expended energy would be avoided.

In recommending State interference in secondary education, it is necessary to point out the limits within which such interference is practicable and desirable. The universities have already undertaken the examination, and, in certain cases, the inspection of schools; and these bodies, with the College of Preceptors, possess greater facilities for such work than the Government would be able, except at a great cost, to provide. What is needed is that all secondary schools should be scheduled, and all teachers registered; that the Government should be made cognizant of, and should have the right of approving or of disapproving, the several schemes of instruction adopted in our schools; that care should be taken that every town and district is provided with adequate facilities for secondary education, and that the curricula of different schools be adapted to the requirements of different districts; that schools in the same district should not unnecessarily, and to their mutual detriment, compete with one another; and that scholarships should be so employed as to place secondary education within reach of every child from an elementary school capable of deriving real benefit from it. As regards examination and inspection, it is not

desirable that any rigid system should be adopted similar to the Government examination of individual pupils of elementary schools The greatest latitude consistent with efficiency should be permitted. It should be the duty of the State, however, to see that no school escapes inspection; and to entrust to certain authorised bodies the duties of examining and inspecting. It might be left to the governors of endowed, and to the principals of private schools, to elect to be examined by any one of such duly nominated public bodies. No one who advocates the appointment of a Minister of Education desires to discourage the multiplication of schools of the most varied character, nor to introduce uniformity either in the methods or subjects of instruction; nor, indeed, to restrict in any way the free choice of the parent in the selection of the school to which he shall send his son or daughter. What is desired is that the fullest publicity shall be given to the character of the educational work carried on in different schools. Without attempting, except when required to do so, to undertake the duties of examination; without unduly interfering with different schemes and methods of instruction, there is abundant useful work in the field of secondary education, which might with advantage be undertaken by the State, and which, if properly discharged by a department responsible to a Minister, might be the means of placing our secondary education on a more satisfactory basis.

It is to the organisation of our secondary education that we must largely look for that improvement in the efficiency and capabilities of our industrial classes which we are too apt to believe can be brought about by the establishment of professional schools, whether technical or commercial. Professional instruction is now an indispensable complement of workshop or office practice, but its efficacy is altogether conditional on the fitness, for the practical needs of the people, of our elementary and secondary education, the organisation of which—and, especially as regards commercial training, of the latter—should engage the serious attention of thoughtful statesmen.

CHAPTER IV.

TECHNICAL INSTRUCTION IN ELEMENTARY SCHOOLS.

THE establishment of large factories, in which goods, formerly made by hand and in small numbers, are now turned out by machinery in thousands, and the practical cessation of the system of apprenticeship, have given rise to various educational wants which now for some years people have been endeavouring to satisfy. Some persons have thought that a new and improved method of teaching trades was needed; and in many places an attempt has been made to solve the problem by the establishment of apprenticeship schools for the training of workmen. Others have believed that technical universities, in which the highest branches of science might be studied, would supply trained heads of departments; and that the 'hands' might be left to pick up their training in the shops. It seemed, indeed, that the development of the principle of division of labour was tending to separate the thinkers from the workers; and that whilst the former needed the best scientific teaching, the latter required only manual skill. Gradually, however, we

have come to understand that the changed conditions of production demand what approaches very nearly to a revolution in our educational methods, and a shunting on to new lines of the instruction given in the several grades of schools.

All education, to be useful, should have reference to the life-interest of those who receive it; it should aim at the development of man, with a view to his work in life. For this reason, it is necessary, that the educationist should understand the nature of the subject he has to develop, and should, at the same time, have regard to the environment in which it is to work.

'To prepare us for complete living is,' according to Herbert Spencer, 'the function which education has to discharge;' and foremost among the 'activities' which constitute human life, he places those which directly or indirectly minister to self-preservation. A man must be able to gain the means of living before he can discharge any of the duties or enjoy any of the pleasures of life. One of the first objects of education, therefore, should be to give a child such a training as shall prepare him for gaining a livelihood. This is not the only function of education, but is a most important one. A man has to discharge the duties of citizenship, for which social and moral habits have to be formed, based on a knowledge of social and moral laws. His education, if complete, should also enable him to furnish himself with the means of enjoying life

in the wisest manner, and of making the best use of his leisure. But, in any theory of education, it is important to regard education not only as a discipline for the development of mind and body, but also as a training for the proper discharge of the functions and duties of living. Education is not simply a drawing out of the faculties, but is a development of the faculties *with a view to certain ends.*

Supposing this view to be correct, we have now to apply it to that grade of education which is known as elementary or primary, in order to see to what extent our present system is satisfactory. In dealing with the education given in our public elementary schools, which are intended for the training of children of the poorer classes, we have to remember that the years devoted to school life are necessarily few, and that the schoolmaster's work has to be accomplished in a very limited period of time. The case is different with the education of the middle and upper classes. The age at which a child leaves school is an important factor in determining the curriculum of studies to be adopted. For this reason, the primary education of all children cannot be laid on exactly the same lines. If a child is likely to remain at school till the age of eighteen, his education may be built on a broader foundation than if he leaves at the age of thirteen. This fact is recognised in all our public elementary schools, and explains what one so often hears—that the poor man's child knows more

at the age of ten or eleven than the rich man's child. But the acquisition of knowledge does not by itself constitute education, although there is much in our present system of examination and inspection which might lead one to suppose it does. Whether school life be long or short, it is desirable that it should prepare the child for complete living, and should aim at enabling the child to acquire for himself the knowledge that will prove most serviceable to him. In the education of the children of the poor, due importance should be attached to the cultivation of their faculties by exercises, which have reference to their future occupations, and are likely to facilitate the acquisition of manual skill. In our Elementary Education Code of 1870 these principles were not sufficiently considered. The education which it encouraged was too literary; it appealed too much to the memory and not enough to the senses, it relied on teaching too much through the medium of words and too little by things. The Code of 1870 had other defects, which subsequent Codes have sought to lessen without attempting entirely to remove.

It is now, I think, generally understood that the system of 'payment by results' cannot, in its present form, continue to regulate the distribution of the parliamentary grant in aid of elementary education. Many of the defects in our present method of instruction, and in the [illegible] are traceable to the operation of this system. [illegible]

such principle may have been at first necessary, and that it has been the means of securing a fairly just distribution of public funds, and of encouraging, up to a certain point, a wholesome rivalry among different schools, may be readily admitted. But the working of the machinery has given rise to evils which were not contemplated when the system was first set in motion; and the time has now arrrived for the reconsideration of the whole question. To provide a satisfactory substitute for the present system is not, however, as easy as is sometimes supposed, and must involve some change in the methods of inspection, and possibly in the proportion of the amount of imperial grant to that of local rates in aid of elementary schools. If, however, our teaching is to be improved, the system must be remodelled. Our teachers have shown themselves worthy of a larger share of confidence than they can possibly receive under the existing Code; and there can be little doubt that their teaching would be better in proportion as that confidence is increased.

The restrictions under which the elementary schoolmaster works require to be relaxed. There is no essential difference between his duties and responsibilities and those of the head master of a middle-class school largely dependent on endowments for support. What is needed in both cases is that the teachers shall be well trained, and that the inspection shall be thorough, so that the public may be assured that the funds provided are properly applied. If, under

the present system, our elementary teaching is mechanical, the fault is largely due to the machinery by which the teaching is paid for.

Nevertheless, the Code of 1870 was a great step forward in the educational progress of this country. With all its defects, it laid the foundations of a broad national system of education. If our artisans are behind the artisans of other countries in technical knowledge and skill, they would have been still more backward if the passing of that great measure had been delayed. Among the most active and ardent supporters of technical education at the present time, are the artisans, who have received their education at some of the Board schools, called into existence by the Code of 1870. The knowledge they have tasted makes them thirst for more. They are able to tell us wherein their early training was defective, and it is they who have helped us to understand the changes in our system that are needed in order to make our elementary instruction a more fitting preparation than it now is for the practical work of life.

I.—Reading, Writing, and Reckoning.

The best system of primary education would be one based on an extension of the principles of the Kindergarten. The ideas underlying Frœbelism are applicable to education generally. There should be no break between the training of the Kindergarten and that of the elementary school; there should be

a progressive development in the exercise of the senses by bringing them into closer relation with natural objects. As regards technical education nothing else is needed than that the method of the Kindergarten should be extended to the elementary school. All that is wanted follows from the application of this principle. Children must, of course, learn to read and write in order that they may communicate with, and participate in the thoughts of, others. Reading and writing are adjuncts of speech. They are a necessary part of the equipment of every child for the discharge of all the duties of life. At best we can hope to gain by actual experience a small fraction only of the knowledge we should desire to possess. The rest we must acquire by availing ourselves of the experience of others. A great portion of all knowledge can be obtained in no other way. Personal experience cannot tell us what happened a hundred years ago. For a knowledge of the events of past times we are entirely dependent on oral traditions or on books. Geography might be learnt exclusively by travelling, and science by actual experiments; but if we were restricted to such means of information, our knowledge might be much more exact than it is at present, but it would be much more limited. We must depend to a great extent on the labours of others, both of those who have preceded us and of our contemporaries. But education, to be of any value, should enable us, by placing us

in similar circumstances, to understand and realise the processes by which the knowledge which we receive, so to speak, second hand, through books, has been acquired. We should know how to verify what we accept as true, by having learnt, by actual experience, how such truths have been ascertained, and how such knowledge has been built up. This applies even to the teaching of history, which is a record of events more or less similar to those which we ourselves from day to day experience; and, according to the method of instruction, are we enabled to distinguish among the records of the past, between fact and fiction, between what is probable and improbable. Reading, therefore, is in reality a means of widening our actual experience, and as such is an essential part of education. But, although, in the hands of a skilful teacher, instruction in reading may be made a useful mental discipline, its main object is to fit us to acquire the indispensable means of self-cultivation.

After reading, writing is the most important part of primary education. Writing is a new language, enabling us to communicate at a distance with our fellow-creatures, and to preserve for future reference our own thoughts. But writing is an art, and as such may be regarded as a part of technical education. To write well is a useful accomplishment, which has a commercial value. Of late, the art of penmanship has been too much neglected. There is difficulty now in finding youths who write well enough

for the various purposes for which good writing is required in business and other offices. More time might, with advantage, be spent in acquiring an art, which would be found serviceable to youths seeking employment at an early age. To enable children to write clearly and distinctly is a part of primary instruction; to enable them to write elegantly belongs to technical or professional education. But, with a very little additional expenditure of time, writing might be so taught as to be commercially useful.

It has been suggested by very competent authorities that the teaching of drawing in its earlier stages may be combined with the teaching of writing. This has not been widely tried. But there is no doubt that the ability to form straight and curved lines, which is acquired by learning to write, may be utilised in drawing exercises, and that very simple combinations of the lines used in writing large text-hand may be made to produce various patterns and designs, and help not only to train the hand, but also to exercise the imagination. Much more, however, than this is needed if drawing is to be taught as a useful art in our elementary schools.

The third of the essential elements of primary instruction is reckoning. I am not here concerned with the best methods of teaching arithmetic. The discussion of this subject belongs to special works on Method. But in the teaching of arithmetic, a basis may be laid for the superstructure of technical educa-

tion. To this end too much time should not be devoted, in the earlier stages of instruction, to the explanation of processes. Arithmetic should be taught in the first place as a useful art. The explanation of processes involves methods of reasoning with which a young child cannot be expected to be familiar; and the object of the study is not to teach the theory of numbers, but to give the child the ability to reckon. As an exercise in reasoning, the explanation of processes is most valuable, but it belongs to a later period of the child's education. Facility and accuracy of work should first be aimed at.

In teaching children to reckon, concrete examples—that is, examples dealing with measurements of actual things—should be preferred to calculations with abstract numbers.

Far too much time is often spent in complicated exercises in long division, in reducing complex fractions to simpler forms, in finding the greatest common measure of two numbers, and in problems which a knowledge of the elements of algebra enables the scholar to solve with ease. A child wants to learn as soon as possible to work out simple exercises on the length and area and contents of things, on weights and measures, and on money values; and the units of weight and measurement should be such as are in common use, and not those which are found in tables only. As far as possible the child should be exercised on measurements which he can himself verify,

or with which he is at least familiar. A foot rule may be made to illustrate a number of useful exercises in arithmetic, and is a piece of apparatus with which every child should be provided. Sets of weights and measures should, of course, be found in every schoolroom in which arithmetic is taught. The approximate verification of arithmetical examples by actual measurement is a most valuable exercise, as preliminary to technical instruction. The realisation of abstract calculations is most important at all stages of the pupil's progress. Again, short methods should always be encouraged, and approximate results should be accepted, the limit of the error being fully indicated. The time spent in obtaining accurate results involving fractions with several figures in the numerator and denominator might be more usefully employed in solving such questions as are likely to occur in actual practice. Indeed, much that is found in nearly all books on arithmetic, under the heading of 'vulgar fractions,' might be altogether omitted or postponed for more advanced instruction. On the other hand, an early introduction to decimal fractions is most serviceable, both in helping to explain our system of notation, and in familiarising the child, at an early age, with the kind of calculations he will afterwards have to make. As illustrating the application of decimals, the child should learn the metric system of weights and measures, a knowledge of which he is likely to require in his subsequent

technical work. The several measures should be found in the school for illustration, and should be used for verifying arithmetical exercises. Indeed, no opportunity should be lost of quickening the intelligence of children, and of stimulating their observing faculties, by constantly directing their attention to actual things. It is the teaching through the medium of abstract ideas that fails to impress, and generally wearies the child. Technical education is essentially a *real* education, and as such its method is to proceed from things to their properties, and thence to the principles that connect these properties with one another. To no class of children is methodical instruction of so much moment as to those who are being educated in our elementary schools. If children continue their schooling to the age of seventeen or eighteen there is time to correct early mistakes; but in the case of children who leave school at the age of twelve or thirteen every hour is of importance, and should be fully utilised. In the teaching of arithmetic an excellent opportunity occurs of laying the foundation of a child's technical education. No subject of instruction lends itself more easily to the development of habits of accurate and exact thought, and to the training of the rudimentary reasoning faculties of the child. And this disciplinary value the study of arithmetic may be made most readily to yield, by teaching the subject in connection with its practical applications.

II.—DRAWING AND MODELLING.

If education is to prepare us for complete living, the instruction given in our elementary schools must do more for our children than place them in a position to gain information through the medium of books. It has been often said that if you enable a child to read, and to understand what he reads, you place him in a position to gain, by his own efforts, any further amount of knowledge, and that the duty of the State, so far as education is concerned, is thereby discharged. But this view of the functions of education is too limited. Reading is not the only, nor indeed the chief, key to knowledge. Reading can only give us facts and truths at second hand. No education is complete, how elementary soever it may be, which does not show us the methods by which knowledge has been created, and give us some training in their use. Observation and experiment are the instruments of knowledge which we employ continuously through life; and education, if it is to fulfil its purpose, must prepare us to use these instruments. The recognition of this fact brings into prominence the importance of the early training of our senses, and the advantages of exercising the organs we employ in observing and in testing.

If I were writing on elementary education generally, I should have to consider the best means to be adopted for the development of the social and

moral faculties of the child, the necessary training for the inculcation of habits of truthfulness, unselfishness, and thrift, and for the formation of character. It is needless to point out that success in life depends as much upon the possession of these qualities as upon the power of acquiring scientific knowledge or technical skill. But our inquiry is limited to the consideration of the subjects and methods of instruction, which should be introduced into the curriculum of our public elementary schools, in order that the education provided in them may prove a suitable preparation for industrial life.

For this purpose, it is now evident that the old literary or 'bookish' education is inadequate, and we have to consider in what way it needs to be supplemented. In the first place, we have to realise the fact that, for the majority of mankind, to live by the sweat of the brow means to live by the labour of the hand; and that the hand is a powerful and delicate instrument, capable at once of answering to the call of the strongest muscles of the body, and of responding to the keenest perception of the eye. It is the instrument of skilled and of unskilled labour; and it is the function of education to adapt it to the uses of the former. The recognition of the importance of cultivating the hand, not only as an instrument of artistic skill, but also as an organ for acquiring knowledge, is a distinguishing feature of the New Education. The hand, properly cultivated, helps to convey to the mind

accurate information of the external world, and is the instrument by which mental images of form and beauty are impressed upon crude and shapeless matter. It is a channel through which the mind is enabled to perceive the properties of things, and the implement by which it impresses upon things its own ideas. The artisan who fixes in clay, in wood, in ivory, or in silver the forms of beauty projected from his mind is a true poet.

There are many ways in which hand-culture may be made a part of elementary education. The methods of the Kindergarten should be continued. Part of the value of Frobelism lies in its suggestiveness for utilising the hand in acquiring knowledge through things, and in representing in things the pictures of the mind. One of the first and simplest means of cultivating the hand and of making the hand and eye work in harmony is in the teaching of drawing. Educational theory and the needs of practical life alike prove to us that drawing lies at the very root of what we call 'technical' instruction. It seems strange to us, that whilst many subjects should have been taught in our elementary schools the usefulness of which, whether considered from the point of view of educational discipline or of value in practical life, is very questionable, drawing, which fulfils all the conditions of a subject for school instruction, should have been, in this country so generally neglected.

There is almost a consensus of opinion among persons who have thought about the subject, as to the necessity of making drawing an obligatory part of elementary education. It is the most important of all the means suggested for the training of the hand and eye; its practical uses in industrial life are universally recognised; and, as mental discipline, its value is attested by the stimulus it affords to the accurate observation of things. As a universal language, it ought to be taught to all. By writing, we are understood by those only who know the language in which we write; but drawing affords a means of expression which all who run may read. To the artisan, drawing is essential that he may be able to receive or to give instructions and to properly understand his own work. To be taught to draw is as essential to a child who is to be employed in any one of the mechanical arts as to be taught to speak or to write. It is one of the three modes of expression which every one should have the opportunity of learning. To make the teaching of drawing obligatory in all elementary schools is the first reform needed to adapt our system of education to the practical requirements of life.

A distinction must be made between freehand and geometrical or linear drawing. All children may and should be taught a little of both; but some children show an aptitude for the former which should be encouraged, and may be the means of determining

their future occupation. There are many children, however, who have little or no artistic perceptions; and these, after having learnt the elements of freehand drawing, should be permitted to discontinue it for the more essential study of geometrical or linear drawing. If the Kindergarten teaching be followed up without any break, it will be found that the majority of children of the second or third standard will be able to sketch, with more or less accuracy, some of the simpler things they see around them. Very few of these are likely to develop into artists or designers; but all will have derived immense benefit from the habit of looking at things closely and carefully, as they must do, to represent them, how imperfectly soever, on paper. The cultivation of the habit of accurate observation, which is acquired by drawing, is a part, and a very important part, of the discipline of science; and in this way, and indeed not only in this way, the one study assists the other. But, in order that drawing may yield its full value as a means of mental training, the pupil must be brought face to face with natural objects. It helps him little or nothing that he can copy copies. He must depict things. He must look at things till he knows them, and must acquire the ability to represent them on paper. There is this in common between science-teaching and art-teaching, that both should bring the pupil into immediate contact with nature. It is because drawing may be made the means of directing observation to the form of

things that the teaching of it is valuable, apart altogether from the use which the pupil may make of the skill acquired. It is desirable, therefore, that the pupil should be taught from the very first to draw from natural objects. Much difference of opinion has been expressed as to the advantage of letting children commence by drawing from things; but the prevailing practice of the best foreign schools is found to fully support the views of educationists as to the importance of accustoming the child, as soon as he can use a pencil or a brush, to draw from real objects.

And in teaching drawing, the brush should be more generally used than it is at present. Children do not see things in outline, but as occupying a coloured portion of space. They should be taught to represent them as they see them; and should, therefore, be encouraged to draw with the brush in colour. Not only do they thus obtain a more adequate representation of the external object, but the exercise of painting is more interesting to the child than that of outline drawing, and he obtains, in addition to his knowledge of extended form, a knowledge of differences of shade and colour. Many children who show little aptitude or inclination for drawing with the pencil are pleased and interested by the use of paints; and there is little doubt that drawing would be more generally liked as a study, if the brush were substituted for the pencil in teaching it.'

But there is no better way of selecting for further

training those children who exhibit any decided art-aptitude than by teaching drawing indiscriminately to all. From those who exhibit such an aptitude the bulk of industrial designers would be formed. It has been shown by competent authorities that design can be taught more easily than has been generally supposed, and at a much earlier stage of a pupil's progress. With a view to the training of industrial artists, it is a matter of the greatest importance that children should be early taught the principles of design. Much of the Kindergarten practice is exercise in design, and this should be continued in the elementary school.[1] Children showing any special skill in drawing will afterwards apply that skill to the practice of this craft, and will thereby add beauty to every piece of work that passes through their hands. Notwithstanding the great development of production due to the application of machinery to nearly every branch of industry, the taste and desire for handwork is on the increase. But such handwork, to be readily saleable, must bear upon it the impress of artistic skill. Moreover, as the ability to create beautiful and suitable designs — not only in materials to be fashioned by the hand, but also in those to be wrought by machinery — depends greatly upon the designer's knowledge of the material itself, and of its adaptability to the pattern, the

[1] See *Cours Élémentaire de dessin à main libre*, by Van Der Haeghen, for a notice of the Belgian system of instruction.

artisan who is familiar with the material, and with the processes by which the design may be reproduced, is better qualified than any one else—provided only he has received a proper training—to become an industrial designer. Here we see the great economic advantage of teaching drawing and design to the children of the working classes, *i.e.* to our future artisans. If they receive a suitable art training there is nothing their hand touches which their hand may not beautify. Not only will the worker in metal, wood, or lace prove the best designer of new patterns to be wrought in these materials, but he may add original grace and beauty to his labour which will enhance considerably its value. It is nothing else than the neglect of art training that has made us as dependent as we have hitherto been on foreign artists for original designs in nearly every kind of material and fabric, and has led to the importation in such large quantities of fancy articles, showing taste and beauty and artistic skill. If our handwork and the products of our machinery are to hold their own in beauty of design with those of other countries, the foundations of artistic training must be laid in our elementary schools.

But there is another branch of drawing which is equally, if not more, essential as a part of the industrial education of all children, viz. mechanical or linear drawing. Nothing is better worthy of imitation than the methods by which this kind of drawing

is taught in the day and evening schools of France and Belgium. The absence of such instruction has already proved a serious disadvantage to many of our English artisans. By drawing to scale, children learn to represent the plan and elevation and the different sections of simple objects, and also to read and understand working drawings when placed before them. Such instruction lies at the very root of technical education. Although more essential to boys who are likely to be engaged as carpenters, masons, cabinet-makers, mechanics, or in other constructive industries, drawing to scale is scarcely less useful to tailors, shoemakers, and dressmakers. Moreover, whilst there are many children who show no natural aptitude for freehand drawing, and who are wanting in imagination and in the faculty of representation, which might enable them to become successful artists or trade designers, there are none who cannot be taught to use drawing instruments, and scarcely any to whom the instruction will not prove serviceable. There is, too, an educational value, as mental discipline, in the instruction, quite apart from its usefulness, in the practice of the arts, that fully corroborates the important dictum of Herbert Spencer, which should be exalted into a pedagogic axiom: *the education of most value for guidance must at the same time be the education of most value for discipline.*

There is another hand-exercise, which, following

on Kindergarten practice, should form part of the curriculum of elementary schools, viz. modelling in clay. Modelling may be regarded as the complement of drawing. In its earlier states it is an easier, and is generally found to be a more interesting exercise. The first efforts of the pupil should be directed to the production in clay of a fac-simile of some simple solid object, such as an orange or a pear. The resemblance between the object and the clay model will be more easily recognised by the child than the likeness of the object to its outline on paper. In the production of the solid model there is a gratification of the sense of power, which affords the child more satisfaction and pleasure than in making a representation of the object on a flat surface. The training of the eye in appreciating form and size is very valuable, as is also the exercise of the hand in translating into the concrete the visual impressions. Any one who has witnessed the concentration of thought shown by children engaged in modelling, and their successive efforts to make their model similar in shape and size to the object before them, will realise the value of such lessons as sense exercises. Lessons in modelling may be easily graduated, and as the pupil advances he may be taught to model from ordinary drawings, producing in relief what he sees in the flat. The relation between an object and its picture will be best understood when a child can correctly depict the object on a flat surface, and can, conversely,

produce a solid object from its pictorial representation. The skill acquired by modelling is of great practical use in the plastic arts, but as a subject of elementary education its value is greatest as an educational discipline.

Modelling requires very simple and inexpensive appliances, and it can be taught with equal advantage to boys and girls.

III.—Woodwork.

The advantages of a further development of hand-culture than is possible through the teaching of drawing and modelling have been much canvassed of late years, but the prevailing opinion is decidedly favourable to the introduction of some kind of handwork in schools, by which boys may learn the use of ordinary tools, and may acquire some skill in the construction, in an easily workable material, of simple objects from properly executed drawings. It is to the French that we mainly owe the encouragement which has lately been given to the teaching of woodwork in schools. Although the system adopted in the well-known Communal School in the Rue Tournefort[1] has not been generally followed in France, nor in other countries, the efforts of M. Salicis, the founder of the school, seconded by M. Laubier, the present

[1] For a full description of the work of this school see *Le Travail Manuel*, by D. Laubier and A. Bourgerret, Paris, 1887.

head master, have been successful in directing attention to the importance, both from an educational and economical standpoint, of handicraft instruction; and in the year 1886, out of 174 primary schools supported by the City of Paris, 95 were provided with workshops; 90 for instruction in carpentry and wood-turning, and 5 for metal work.

In these schools, the manual teaching has hitherto been given either before or after the ordinary school hours, but the Municipal Council of Paris attach such importance to this training that it is proposed to make the workshop instruction a part of the regular school curriculum. In the higher elementary schools of France the training is carried to a much more advanced stage. Belgium has followed France in recognising the advantages of workshop training, and in the United States a public opinion in favour of manual training is being rapidly formed, which promises to exert an important influence upon the educational and industrial progress of the American people.[1] In Germany and Switzerland, workshop instruction has not yet been introduced into the popular schools; but a seminary has been established at Leipzig for the training of elementary teachers in woodwork and in other branches of handicraft. In Sweden, 'Slojd' is generally taught in elementary schools. The *Ambachts* schools of Holland and the

[1] See the monographs and other papers [illegible] by the 'Industrial Education Association,' New York, U.S.

Fachschulen of Austria contain workshops, but these are properly higher elementary or trade schools.

It cannot be too often repeated that the object of workshop practice, as a part of general education, is not to teach a boy a trade, but to develop his faculties and to give him manual skill; that although the carpenter's tools may be employed as instruments of such training, its purpose is not to create carpenters. The absence of any good word to express all that is implied by manual instruction, as given by a competent teacher, is one of the causes of the lingering belief that the object of the instruction is to make tradesmen, who, it is justly said, can be much better trained in the shop. To dispel this illusion it is necessary to explain what are the objects and advantages of the instruction, and by what means they can best be realised. It would be some gain if the Swedish word 'Slojd' could be employed to indicate the system of instruction. But, unfortunately, 'Slojd,' which is a very good term, supposed to be connected with the English word 'sleight,' as used in the phrase 'sleight of hand,' implies a particular system of hand culture, which is, no doubt, well enough adapted to the industrial conditions of Sweden, but differs in many respects from the system which, with such experience as we have already gained, can be recommended for adoption in this country. The term 'Slojd,' or 'Sloyd,' however, might be accepted as a general name for workshop instruction, the object of which is

not the teaching of any particular trade; whilst the method of the instruction might vary in different countries, or even in different parts of the same country, according to the views of the teacher or the wants of the pupils.

As a discipline supplementary to that of drawing and modelling, workshop instruction, by whatever name it may be called, is valuable as teaching a knowledge of *substance* in addition to that of *form*. Moreover, under competent instructors, it may be made an instrument of education similar in many respects to practical science. The operations to be performed in the workshop are less delicate, the instruments are more easily understood, the substances employed are more ordinary; but the training is very similar, and in so far as the faculties exercised are those of observation rather than of inference, the training, educationally considered, is a fitting introduction to laboratory practice. Moreover, the skill required in the workshop is particularly useful to the laboratory student, in enabling him to make and fit apparatus, and in giving him that adroitness on which progress in scientific work so much depends. Whilst manual training is valuable in the education of all persons—a fact which is already recognised by the head masters of several of our public schools—the usefulness of this kind of training is much greater in the case of the children of the working classes, whose education is too limited, and often too

hurried, to admit of any practical science teaching, such as older children obtain, and to whom the skill acquired is of real advantage in inducing in them an aptitude and taste for handicrafts, in facilitating the acquisition of a trade, and possibly in shortening the period of apprenticeship, or of that preliminary training which in so many occupations takes the place of it.

An objection is sometimes raised to the introduction of wood-work into elementary schools on the ground that, as the children of the poorer classes necessarily leave school at an early age, and spend their lives for the most part in manual labour, such time as they can give to study should be occupied in other pursuits—in cultivating a taste for reading, and in the acquisition of useful knowledge. This objection is due to a misconception of the true objects and aims of education, and to an imperfect acquaintance with the methods adopted in workshop instruction. People often talk and write as if school-time should be employed in teaching those things which a child is not likely to care to learn in after-life; whereas the real aim of school education should be to create a desire to continue in after-life the pursuit of the knowledge and the skill acquired in school. In other words, the school should be made, as far as possible, a preparation for the whole work of life, and should naturally lead up to it. The endeavour of all educators should be to establish such a relation between school

instruction and the occupations of life as to prevent any break of continuity in passing from one to the other. The methods by which we gain information and experience in the busy world should be identical with those adopted in schools.

But in order that the teaching may not degenerate into mere craft lessons, the methods of instruction must be carefully considered. That the training of the hand and eye, and the development of the mental faculties are the objects to be aimed at, should never be lost sight of. In many respects the instruction should partake of the character of ordinary object-lessons. Before the pupil commences to apply his tools to the material in hand, he should learn something of its nature and properties. The teacher should briefly explain the distinguishing characters of the different kinds of wood, as met with in the shop, and as found in nature, and also the differences in the structure and the properties of wood, according to its treatment. He should further illustrate his lessons by reference to specimens and examples, a collection of which should be found in every school workshop. Something should be said of the countries from which timber is imported, and the conditions under which it is bought and sold. In this way the material to be manipulated should be made the text of a series of scientific object-lessons. Concurrently with the practice in the use of any tool, the pupil should learn its construction, and the reason of its shape. The

foot-rule, the saw, the plane, and the chisel, might each serve as an object-lesson for the pupils. The teacher should also explain the purposes of the different parts of constructive work, and should have models of tenon, mortise, dovetailing, and other joints to illustrate his explanations. Fifteen or twenty minutes thus spent might be made the means of stimulating and of exercising the observing and reasoning faculties of the children, and of enabling them to fully understand the work they are doing and the instruments they are using.

Further, the children should be taught as soon as possible to work from correct scale drawings from their own rough sketches. However simple the object may be which the pupil is to construct, it should exactly correspond with his own drawings. In this way, the workshop instruction supplements and gives a meaning to the drawing lesson, and the school teaching is made to have a direct bearing upon the subsequent work of the artisan. Dr. Woodward, the instructor of the St Louis Manual Training School, who has had considerable experience in organising and superintending workshop instruction, tells us: 'The habit of working from drawings and to nice measurements gives to students confidence in themselves altogether new;' and he justly claims 'that it is the birthright of every child to be taught the three methods of expression — 1st, by the written, printed, or spoken word; 2nd, by the pencil and brush, using the various

kinds of graphic art; 3rd, through the instrumentality of tools and materials which enable one to express thought in the concrete.'[1]

Great use should be made of the black board in these lessons, and the pupil should be practised in copying on paper, from drawings produced on the black-board by the teacher, plans and sections of different kinds of joints, and of simple objects. The value of the lessons consists in the combination of descriptive object lessons with geometry, drawing, and constructive work.

Both as regards the descriptive and practical instruction, a careful scheme of lessons should be prepared by the teacher, so that the pupils may be taken, step by step, from simpler to more difficult tasks.

The experiment of introducing workshop instruction into public elementary schools has recently been tried, under very favourable conditions, by the School Board for London. Six schools were selected, three on the north of the Thames, and three on the south, and children were admitted to the classes from the neighbouring schools. The necessary funds were supplied by the Drapers' Company, and the scheme of instruction was elaborated by a joint committee of the School Board and of the City Guilds Institute. The syllabus, as approved by the committee, is given on the adjoining page.

[1] [illegible] p. 5[illegible]

I	II.	III.	IV.	V.
WOODS COMMONLY USED	TOOLS—	PRACTICAL WORK (A).	PRACTICAL WORK (B).	PRACTICAL WORK (C).
(*a*) Conditions of Growth.	1. *Boys' Set.*	Measuring and Sawing to line.	(*a*) Construction of Simple Joints according to Model and Drawing.	(*a*) Glueing.
(*b*) Felling and Seasoning of Timber.	(*a*) Description.	Squaring piece of wood.		(*b*) Hinging.
	(*b*) Manipulation.			(*c*) Knots—Tying, &c.
(*c*) Properties of Woods.	(*c*) Sharpening.	Nailing and Screwing.	(*b*) Construction of Simple Objects founded on Simple Joints.	
(*d*) Heart-wood, Sap-wood, &c.	2. *'Centre' Set.*	*Construction of Simple Joint.*		
	a, *b*, *c*. As above, less of detail.	(*a*) Exhibition of Model of Joint.		
	3. *Nails.*			
	(*a*) Kinds.	(*b*) Explanation of Drawing of Joint.		
	(*b*) Uses.			
Museum of prepared specimens of woods to be formed in each centre.	4. *2-ft. Rule.* To be specially treated.	(*c*) Connection between Model and Drawing.		

This scheme has not been sufficiently long in operation to enable any judgment to be passed on the results. But it would seem that it is on such lines as these that workshop instruction must be given, if it is to form a part of the ordinary curriculum of our elementary schools.

In organising a scheme of technical teaching in connection with our elementary schools, the difficulty has to be met of obtaining good teachers and competent inspectors. The artisan who is a skilful workman and nothing more may succeed in teaching the elements of carpentry and joinery; but he is not the kind of teacher needed. It is of the utmost importance that the teacher should be a good draughtsman, should have some knowledge of physical science, should be a fairly expert workman, and should have studied the art of teaching. To obtain at first such ideal instructors would be impossible; but there is no reason why gradually they should not be trained. Two processes suggest themselves. We might take a well-trained elementary teacher, having an aptitude for mechanical arts, and give him a course of instruction in the use of tools, either in a technical school or in an ordinary workshop. Or, we might take an intelligent artisan, who had studied science and drawing in some of the excellent evening classes which are now found in almost every town, and give him a short course of lessons on method in relation to workshop instruction. Good teachers might be ob-

tained by either of these processes. But the former is certainly preferable, for the simple reason, that the instruction should be regarded as a part of the general education of the boy, not as a part of his apprenticeship. The trained teacher who has received a course of workshop instruction will undoubtedly be better able to make his lessons yield educational discipline than the tradesman who has had no pedagogic experience. On the other hand, the expert carpenter would be preferable if the object of the instruction were to teach the boy a trade. The great difference between the two instructors is—that the one has a deeper insight into the nature of the children, and the other a more thorough acquaintance with the practical details of the work in which they are engaged. Of course, a knowledge of the materials employed and sufficient manipulative skill are absolutely essential for the teacher of woodwork; but no less essential for the teacher of young children is a knowledge of the methods of instruction, founded on some acquaintance with the psychology of child-life.

At the Central Institution of the City Guilds, classes have been formed for the instruction of school teachers under the direction of the professor of engineering assisted by competent artisans; and in these classes the teachers have had the opportunity of acquiring manual skill and also a knowledge of the best methods of instruction. If workshop instruction is to take a place in elementary education,

it is desirable that the teachers should be trained schoolmasters. The ordinary mechanic, who will be found to be most serviceable as an assistant to the teacher, is generally unaccustomed to deal with very young children, is unacquainted with the graduated methods by which all sound instruction is imparted, and is too apt to treat his pupils like apprentices, who learn their trade by being shown 'how to do it' without understanding the reason why. It is an essential part of the Swedish system of 'Slojd' to place the workshop instruction under the direction of a trained schoolmaster. In some other respects, however, the system should not, I think, be too closely followed in our own schools. Those who practise 'Slojd' do not appear to attach sufficient importance to the connection of drawing with woodwork. They regard the usefulness of the object to be made as an essential factor in the choice of exercises; and they are over particular in limiting the number of tools to be used by the child.

The cost of introducing manual training into elementary schools is not so great as is sometimes supposed. An ordinary classroom, about 26 feet by 22 feet, will take five carpenters' benches, each about 14 feet long by 2 feet 6 inches in width, and provided with six vices, affording places for thirty boys, the maximum number to be taught in one class. The benches should be well made, and fitted with every appliance for facilitating the pupil's progress,

the object of the instruction being strictly educational, and the benches and tools being regarded as apparatus for instruction. The cost of the five benches would be about 25*l*.

The room should contain a cabinet for holding tools for general purposes, and specimens of wood. Where several classes receive instruction in the same room, a set of tools should be appropriated to each group of boys who in turn occupy the same bench. This set of tools may be provided at the cost of 15*s*. Besides these tools, some few larger and more expensive tools are required for general use, the cost of which, for each centre, should not exceed 12*l*.

In arranging the scheme of instruction, it will suffice to give each class of thirty boys one lesson a week, of two hours and a half or of three hours' duration. The lessons, as previously explained, should consist partly of oral teaching on the growth and nature of woods and the use of tools, partly of drawing, and partly of practical work at the bench.

The shop thus fitted may be used in succession by different sets of boys from neighbouring schools; but it is preferable that the class, in each case, should receive instruction from its own school-teacher. To employ one teacher continuously to instruct different sets of boys would prove, after a time, tiresome to the teacher, and the teacher himself would gradually lose that sympathy with his pupils' studies in other subjects which it is essential to maintain, if workshop instruc-

tion is to become a part of the general education of the school children. On the other hand, it is an advantage that the artisan assistant should be permanently attached to the school workshop. With such arrangements the cost of the teaching appliances would fall lightly upon each school; for supposing the workshop to be used on only three whole and two half days in the week,[1] it would serve for eight sets, that is, for 240 pupils. The cost of the material would, of course, increase with the number of pupils; but as the work would consist more of exercises illustrating principles than of the construction of useful objects, the quantity of material consumed would not be large, and the cost of it should certainly not exceed 10*s* a month for each class of 30 boys. Differences of opinion exist as to the age at which workshop instruction should commence; but if the teaching of drawing be continued throughout the standards, and be followed or accompanied by lessons in modelling, so that there be no break in the manual training of the child from the time he leaves the infant school, I am inclined to think that, as a general rule, boys should have passed the fifth standard before commencing to use wood working tools.

Whilst advocating the general introduction of manual training into elementary schools, I cannot lose sight of the fact that such instruction is likely to

[1] Time must be left for cleaning the class-room [illegible] and arranging the work exercises.

prove more serviceable to children of urban than of rural schools. In the latter, it would certainly be advantageous to supplement the teaching of woodwork by practical instruction in agriculture. But although a relation must always be maintained between the subjects of school teaching and the activities of life, necessitating elasticity and variety in any code of instruction, practice in the use of woodworking tools will be found almost, if not quite, as serviceable to the children of an agricultural as of a town population. Indeed woodwork is selected as the subject of manual training because the exercise is in itself educational, and because some skill in the use of the tools employed is needed in nearly every trade and occupation. In a recent report of the Committee of Council on Education it is stated :—'After the three elementary subjects and sewing, no subject is of such importance [as cookery] for the class of girls who attend public elementary schools; and lessons in it, if properly given, will be found to be not only of practical use, but to have the effect of awakening the interest and intelligence of the children.' Surely, what is true of sewing and cookery in the case of girls is true to a greater extent of drawing and handicraft in the case of boys. The argument for teaching needlework to girls applies with almost equal force to the teaching of woodwork to boys. The object of teaching girls to sew is not to train professional dressmakers and milliners, but to make girls useful and *tidy* in their

homes; and, apart from the educational value of workshop instruction, one great advantage of it is that it makes boys generally *handy*. It does not make them carpenters nor cabinet-makers, but it enables them to learn any trade more easily. The tools used in carpentry are wanted in many trades, and the boy who has acquired facility in the use of the plane, the saw, and the chisel will find it much easier to learn the use of any special tool he may subsequently need in the practice of his trade. But no small part of the value of workshop instruction is the skilfulness acquired which enables a man to make his home more commodious, to fit a shelf or cupboard, to repair a broken piece of furniture, or possibly to decorate his room. The comfort and cheerfulness of a poor man's home depend almost as much upon the husband's *handiness* as upon the wife's *tidiness*.

Nor must we overlook the moral influence of this kind of training. Dr. Woodward, from whom I have above quoted, rightly says, 'It stimulates a love for intellectual honesty.' It teaches a boy to find out things for himself, to substitute personal experience for the statements of others; it creates, moreover, habits of industry and order. It forms a pleasing alternation to purely literary work, and enables a child to be constantly actually employed. It further teaches self-respect and a respect for the honest work of others. 'A boy who sees nothing in manual labour but mere brute force despises both the labour and the

labourer.' 'With the acquisition of skill in himself comes a pride in the possession, and the ability and willingness to recognise it in his fellows.'

It is often said that all boys have not an aptitude for manual work. This is doubtless true, but it is equally true that every child has not an aptitude for spelling or reckoning. Nevertheless, the three R's are taught to all children indifferently, and when we come to realise the importance of cultivating in children some amount of manual skill, workshop instruction will doubtless, also, find a place among the subjects of primary instruction.

Nearly all educationists have pointed out the many advantages of enabling children at an early age to realise the connection between *knowing* and *doing*. Comenius has well said: 'Let those things that have to be done be learnt by doing them.' Rousseau has pithily expressed a similar idea in saying, 'Souvenez-vous qu'en toute chose vos leçons doivent être plus en actions qu'en discours; car les enfants oublient aisément ce qu'ils ont dit et ce qu'on leur a dit, mais non pas ce qu'ils ont fait et ce qu'on leur a fait.' Richter tells us, 'To know nothing is not so bad as to do nothing.' Locke, speaking of the education of a gentleman—for in his day the education of the poorer classes was scarcely thought of—says: 'I would have him learn a trade, a manual trade;' and Emerson, in the choice words, 'manual labour is the study of the external world,' tersely states the whole aim and purpose of my

remarks. 'The introduction of manual work into our schools is important,' says Sir John Lubbock, 'not merely from the advantage which would result to health, not merely from the training of the hand as an instrument, but also from its effect on the mind itself.' Rabelais, Montaigne, Pestalozzi, Frobel, Combe, Spencer, and others have urged the importance of practical teaching, of studying things before words, of proceeding from the concrete to the abstract. A very valuable and interesting report has recently been issued by a committee of the School Board for London, of which Mr. Bousfield was chairman, in which it is recommended, 'that special manual instruction should be given under the following principles: (1) That manual work be always taken in connection with school teaching of underlying sciences and drawing; (2) that no special trade be taught.' The report further states: 'Woodwork supplies the most convenient mode of giving manual instruction to elder boys. The material is cheap and easy of manipulation, and can be made illustrative of the intellectual work of the school.'

In what I have said I have endeavoured to show that workshop instruction may and should be made a part of elementary instruction; that, as an educational discipline, it serves to train the faculties of observation, to exercise the hand and eye in the estimation of form and size and the physical properties of common things; that the skill acquired is useful in every occupation of

life, and is especially serviceable to those who are likely to become artisans by inducing taste and aptitude for manual work, by tending to shorten the period of apprenticeship, by enabling the learner to apply to the practice of his trade the correct methods of inquiry which he has learnt at school, and by affording the necessary basis for higher technical education.

In this country, we frequently complain that children leave school at too young an age, before they have had time to properly assimilate the knowledge they have acquired, with the result that they soon forget a great part of the little they have learnt. At the age of fifteen or sixteen, when they begin to feel the want of technical instruction, they are wholly unprepared to avail themselves of the opportunities for obtaining it now brought within their reach. A large part of what the nation spends on education is thus practically wasted. It is to remedy this state of things that continuation schools and recreative classes are much needed. But there can be little doubt, if elementary education were made more practical, that parents would be more willing, even at some sacrifice, to let their children benefit by it. They are often led to take their children away from school because they do not see much use in the 'schooling.' Of course the desire to secure the child's early earnings operates in very many cases; but I am convinced that it would be easier to persuade parents to forego these earnings

if the school teaching had more direct reference to the work in which the children are likely to be subsequently engaged.

It was said of James Watt, when a mere child, that 'he had gotten a fortune at his fingers' ends;' and the same might be said of many other children, if workshop instruction were made a part of the curriculum of our elementary schools.

IV.—Science-Teaching.

On the advantage of knowing something of the properties of the different materials by which we are surrounded, and of the laws which regulate the action of the forces which we are constantly endeavouring to control and utilise, it is unnecessary to spend many words. In nearly every action of our lives we are reminded of the services which science renders to our means of living. There can be no longer any question of the necessity of making science-teaching an important element of general education. The late Professor Guthrie well said: 'Though a boy may not be intended for an occupation in which science is required, and though he show little or no aptitude for it, it is as unjust to hide science from him as it would be to hide a knowledge of history, or literature, from those who are not intended to become historians or authors.'[1]

The principles of instruction insisted upon through-

[1] Cantor Lectures on Science Teaching (Society of Arts, [illegible].)

out this chapter are equally applicable to the teaching of science as of other subjects. Looked at from its disciplinary side, the object of the instruction is to cultivate in the pupil habits of accurate observation and of close reasoning; and, from the utility standpoint, to impart serviceable information and to provide definite training in the methods of investigation applicable to all kinds of enquiries.

If these be the objects of science-teaching, they must be kept in view, so far as possible, even in the rudimentary stages of instruction; and we have now to enquire to what extent, and in what way, science can be taught in elementary schools so as to effect these objects and at the same time to serve as a preparation for higher technical instruction.

Having regard to the age of the children attending elementary schools, and to the conditions of their home life, which prevent them from gaining much information from their parents with respect to their ordinary surroundings, it is necessary that the school should seek to supply the place of home, and that the teacher should encourage and try to satisfy that spirit of enquiry which is common to all children. It is not desirable that children should commence at a very young age the study of any isolated branch of science; least of all, that they should try to learn it by such methods as are laid down in any of our approved text-books.' Science may become as 'bookish' as any other subject of instruction if imperfectly taught, and

may even yield less intellectual discipline than grammar. The study of science is valueless unless it stimulates accurate observation by bringing the mind constantly into direct communion with external things. The instruction must be of the kind which the Germans call '*Anschauungsunterricht*,' *i.e.*, instruction, by means of direct perception, in the properties of things, and in the laws, if any, which connect these properties with one another. The spirit of enquiry common to every young child should be encouraged and directed into channels through which the pupil may obtain some insight into the laws and processes of nature, and some knowledge of the methods by which these laws may be ascertained. It is needless to say that the teacher must throw life into the lessons, that he must possess a much higher knowledge of the subject than he can hope to impart to his pupils, and that he should speak from the results of his own experience and investigations. For this reason, it is most important that the teacher of science, even in elementary schools, should have received a proper scientific training, and should be acquainted with the best methods of instruction. The teaching of elementary science to small children is no doubt more difficult than the teaching of science in its advanced stages to older pupils. As the student progresses he instructs himself, and he avails himself of the services of his teacher or professor as a guide only or referee. In the early stages of education, highly

trained teachers are indispensable, and these are equally needed for the proper teaching of science as of other subjects.

As a foundation of technical education, which consists almost entirely of instruction in the application of science and art to different industries, the study of science cannot be commenced too early, and should be continued throughout the whole period of education. 'For, leaving out only some very small classes,' Mr. Herbert Spencer pertinently asks, 'what are all men employed in? They are employed in the production, preparation, and distribution of commodities. And on what does efficiency in the production, preparation, and distribution of commodities depend? It depends on the use of methods fitted to the respective natures of these commodities; it depends on an adequate acquaintance with their physical, chemical or vital properties, as the case may be, that is, it depends on science.'[1] In order that this science may be profitably taught, and that our elementary school teachers may know not only what to teach but how to teach it, it is necessary that they should have further opportunities than they at present possess of being trained under the best masters.

In answer to the question, what to teach? I would say: Some knowledge of the things that immediately surround us—the earth we walk on, the air we breathe, the water we drink, the food we eat, the clothes we

[1] *Education*, by Herbert Spencer.

wear, the trades we practise. These are the subjects, properly investigated, that should constitute the science-lessons in elementary schools. In answer to the question, how to teach them? I would say: By Kindergarten methods, *i.e.* by means of object-lessons systematically pursued. The pedagogic principle—to proceed from the known to the unknown—furnishes the key to the true method of science-teaching.

Taking such subjects as I have indicated as texts, many of the lessons might be made as suitable to one locality as to another; whilst some would have special reference to the geography of the neighbourhood of the school, and to the occupations of the people of the district. In manufacturing towns, a talk about the simpler kinds of machinery in common use might lead up to a study of the rudimentary principles of mechanics; whilst in schools situated in rural districts, lessons on agricultural practice might prepare the way for the systematic study of elementary chemistry. The teachers being competent, and possessing a wide knowledge, and some enthusiasm in the pursuit of science, the lessons ought not to be regulated by any fixed code, nor should the value of the teaching be assessed by the results of any definitely arranged system of examination. Indeed, considerable latitude should be given to teachers and to school authorities; but it is important that the teaching should be based on some fixed principles by

which it might be made the means, not only of imparting useful information about a variety of common things, but of leading, by sure and regular steps, to a knowledge of the simple facts and laws of one or more branches of science. It would be desirable, therefore, that the methods and results of the teaching should be carefully inspected by competent judges.

Under the headings above indicated the paths are very numerous along which the springs of pure science may be approached. As the complex phenomena that present themselves to the senses are stripped of their accidental circumstances, and the laws underlying them laid bare, these laws should be demonstrated by simple experiments, which it should be the endeavour of the teacher to associate in the pupil's mind with the description of the object under consideration. It is only in this way that science-teaching can be made to yield that most important of all educational exercises, the discipline of careful reasoning.

The late Professor Guthrie in the suggestive series of Cantor Lectures, from which I have quoted, indicates the broad lines upon which such object-lessons should be given, and illustrates them by reference to the 'stuffs' that are met with in the building of a house. After considering concrete, sandstone, slate, and other stuffs used in house-building, he says: 'The method of obtaining a light leads to the interesting and instructive subject of matches, and the

stuffs of which they are made. Perhaps, here, the heat produced by friction may be examined, and so a foretaste obtained of the great doctrine of the mutual relationship of the forces, the indestructibility of energy — a doctrine not second in importance to that of the elementary constitution of matter.' The temptation, however, to pass on too rapidly, from the observation of the properties of things, the explanation of their uses, and the causes underlying those uses, to the great generalisations of science has to be carefully guarded against. In science-culture, as in house-building, there are many courses between the foundation and the roof.

Of object-lessons Mr. Herbert Spencer well says: 'They should not be limited to the contents of the house, but should include those of the fields and hedges, the quarry and the sea-shore. They should not cease with early childhood, but should be so kept during youth as insensibly to emerge into the investigations of the naturalist and the man of science.' The difficulty of arranging systematic object-lessons, so as to make them the means of teaching the rudimentary principles of science, is well pointed out by Professor Bain in his excellent work on the 'Science of Education.' 'It is possible,' he tells us, 'by means of the object to approach the primary sciences, namely physics, chemistry, and the rest, with the view of explaining matter and motion, gravity, heat and light; but the manner of doing so needs the

gravest consideration.' Object-lessons, leading up to the study of natural history, are undoubtedly a most valuable part of elementary education, and are generally found to be most serviceable in stimulating observation among young children; and for this reason they may well form part of the science-teaching in all schools. Moreover, in rural districts, and as a preparation for agricultural education, they have a special value of their own. But I am now more particularly concerned with science-teaching as a part of the education of our future artisans; and for this purpose it is necessary that the object-lessons should be directed towards the ultimate study of the elementary principles of physical science. For the ordinary student, there are advantages in studying physical science by the regular systematic methods as laid down in science text-books. But for the young pupil the case is different. Nevertheless, it is so much simpler to follow the regular order that Mr. Bain is right in saying that 'the teacher should always be looking forward to the time when the advancing intelligence makes that possible, and further, he should tacitly keep this order in his mind even when working on the seemingly desultory plan.'

Nearly all writers on education are at one as to the value of object-lessons in teaching the first rudiments of science. The difficulty occurs in finding teachers who are capable of so arranging a series of lessons as to prepare the way for the systematic study

of any one branch of science. As regards method there is general agreement, and few would be found to dissent from Rousseau, who in his 'Emile' tells us : 'Dans la recherche des lois de la nature commencez toujours par les phénomènes les plus communs et les plus sensibles.'

It is easier to point out what should not than what should constitute a good object-lesson. Of the examples of such lessons that have been published, many serve their most useful purpose in indicating what the practical teacher should avoid. We should guard against the error of making the lesson too desultory or a mere verbal explanation of terms. Certain fixed principles, which should dominate the lesson, ought always to be present to the teacher's mind, and perhaps the main purpose of the teacher in these lessons should be to guide and forward the spontaneous powers of observation and reasoning which all children exhibit. It must be remembered that the aim of science-teaching in elementary schools is not to make specialists in science any more than it is the object of workshop instruction to make tradesmen. The real difficulty of the object-lesson consists in the attempt to explain all that the object suggests, and at the same time to keep in view the scientific principles which the lesson ought ultimately to bring out. The full explanation of all the phenomena which are associated with any single natural object demands a knowledge of many different branches of science. In order to avoid

exuberance of explanation, and a too desultory treatment of the matter, the teacher, who should be in full mental sympathy with his pupils, knowing clearly how much, or, rather, how little they can understand, must aim steadily at eliminating some single physical law, which afterwards he should endeavour experimentally to prove. Whilst scientific information is doubtless interesting and of considerable value to the pupil, what is educationally important is to train the child in the methods of science. Starting from the same object, the teacher may arrive, in the process of explanation, at a simple fact or law in dynamics, heat, or electricity. From the very outset, however, he should have clearly in view the goal he desires to reach, and he must avoid the temptation to explain too much. Just as the anatomist in dissecting a limb picks out a particular muscle and demonstrates its function, so the science teacher must try to show the operation of a single law in the bundle of complex phenomena that may be presented to him; and the law having been evolved the teacher should proceed to prove it by rudimentary experimental methods. In this way, by a proper choice of subjects, a few of the leading facts of chemistry, physics and mechanics may be imparted to children by means of explanations of things with which they are familiar, and a good basis may thus be laid for more advanced and more systematic instruction.

For science teaching, such as I have attempted to

describe, some amount of apparatus is needed; but the apparatus should be of the simplest character, and the pupils themselves should, as far as possible, be employed in constructing it, utilising the skill they may be expected to have acquired in their workshop classes. It matters very little that the apparatus employed is rough and simple. The pupil will learn more of scientific method by registering the results of his own experiments with apparatus he has himself made, than by seeing any number of successful experiments performed by his teacher. On this point Rousseau may again be quoted. After expressing his dissatisfaction with the ordinary methods of teaching science, he says: 'L'air scientifique tue la science. . . . Je veux que nous fassions nous-mêmes toutes nos machines. . . . J'aime mieux que nos instruments ne soient point si parfaits et si justes, et que nous ayons des idées plus nettes de ce qu'ils doivent être, et des opérations qui doivent en résulter. Pour ma première leçon de statique, au lieu d'aller chercher des balances, je mets un bâton en travers sur le dos d'une chaise, je mesure la longueur des deux parties du bâton en équilibre, j'ajoute de part et d'autre des poids, tantôt égaux tantôt inégaux; et, le tirant ou le poussant autant qu'il est nécessaire, je trouve enfin que l'équilibre résulte d'une proportion réciproque entre la quantité des poids et la longueur des leviers.' And again 'Sans contredit on prend des notions bien plus claires et bien plus sûres des choses qu'on apprend ainsi de

soi-même, que de celles qu'on tient des enseignements d'autrui.'[1] In this sentence Rousseau shows his knowledge of the true educational method, but in its application to science we may now proceed somewhat further than would have been thought possible a century ago.

In order that the pupil may fully realise the results of his own simple experiments, he may, even at this early stage of his scientific progress, learn the use of squared paper for graphically expressing the relation between two varying and dependent factors. Dr. Wormell, in the preface to a little book on 'Plotting,' points out that 'although the educational methods which are associated with the name of Frobel have been brought very near to perfection in the Kindergarten, they are to a great extent suspended when the pupil passes from the infant school.' The use of squared paper is well known in Kindergarten exercises, and also in the experimental science classes of technical schools. It might be made to serve equally useful purposes in the teaching of rudimentary science in elementary schools. If we take a simple pulley experiment, as an example, the pupil might easily note the exact weights that balance each other in different trials, and then by registering the results see how nearly he could arrive at the theoretical law. After a time, the pupil would succeed in obtaining the true law for the apparatus in

[1] *Emile*, livre iii.

use, and the divergence of this law from the theoretic law might yield useful suggestions for other lessons. Other simple experiments might lead to the graphical representation of the law of falling bodies, and to the relation between the pressure and volume of a gas under constant temperature. But such instruction would necessarily be restricted to the highest standards, and might, perhaps, be more appropriately given in schools of a higher grade.

To provide every elementary school, having upper standards, with a teacher competent to give scientific instruction on the lines I have indicated, and with the necessary apparatus, might be considered as involving an unjustifiable expenditure of public funds. In Birmingham, Liverpool, and recently in London, a very successful attempt has been made to overcome this difficulty by appointing a teacher of high attainments, with a wide knowledge of his subject, and skilled in the methods of instruction, to go round from school to school, and to give science lectures to the children and their teachers. This peripatetic philosopher carries with him his apparatus and visits in turn all the chief schools of the town or district. The experiments are carefully prepared at the central depot, and the lessons are given once a week or once a fortnight. Nothing can exceed the interest which these lessons arouse. Nevertheless, the system, notwithstanding the economy of teaching power, has many drawbacks, and ought to be regarded as tem-

porary only, to be discontinued as soon as the ordinary school teachers shall be as well qualified to teach science as history or grammar. What is true of the workshop instructor is still more true of the science teacher, viz., that he should not be a specialist having no share in the general education of the child, but one of the ordinary class teachers. We may take it for granted, as pointed out by Dr. Butler, of New York, 'that any subject which is taught by a special teacher is regarded as an excrescence on the regular curriculum, and as not standing on the same level with reading, writing, and arithmetic.'[1]

Another defect of the system is that the children are not made sufficiently familiar with the apparatus which is used in the experimental lectures. Of the ordinary science teachers of the present day it has been said: 'As a rule, even now, the teacher stands before a black-board and behind a row of bottles, and chalks, and talks, and mixes, and calls it chemistry, or involves himself in a tangle of wires and brass and ebonite fittings, and calls it electricity.' The itinerant teacher is at a still greater disadvantage. He brings with him the apparatus required to illustrate his demonstrations, but, unfortunately, he takes it away again, and the children are apt to look upon his experiments as clever tricks which *he* may be able to perform but which *they* cannot. To learn science

[1] Report of President of Industrial Education Association, May 1888. New York.

properly the pupil must himself perform the experiments. He needs to be brought not only face to face, but into hand-to-hand contact, with Nature's operations. It is in the practice of science that its chief value lies. A repetition of the lesson by one of the teachers would be very serviceable if the experiments could also be repeated, and if the children could take part in them; but otherwise there is a want of reality about the teaching which deprives it of some of its educational value. The advantage, however, of such instruction in awakening the intelligence and of stimulating a spirit of scientific enquiry, even if the method of teaching is not as perfect as it might be, cannot be over-estimated.

Systematic science-teaching by experimental methods can be given only in the highest standards of elementary schools; and there is much to be said in favour of drafting the children of these standards into higher elementary or graded schools, where the more expensive fittings and apparatus which are needed for practical teaching can be more economically provided.

I have now indicated some of the changes needed in our elementary teaching to make it a more fitting preparation than it is at present for the practical work of life. There is reason to hope that many of the suggestions contained in this chapter will be embodied in the recommendations of the Royal Commissioners appointed to enquire into the working

of the Education Acts.[1] Except as regards workshop teaching, and possibly as regards that also, nearly all the suggestions I have made are in every way as applicable to girls as to boys. The analogy between needlework and woodwork has been frequently pointed out; but, in addition to needlework, girls even now receive what may be regarded as technical instruction in cookery and domestic economy. But as regards our future artisans, no great improvement can be effected in their education, and in their fitness to engage in the several crafts and occupations on which the industrial progress of the country so greatly depends, unless the instruction which they receive in our elementary schools is practical in character, and based on the now generally

[1] Since this chapter has been in type the reports of the Commissioners have been published. A perusal of these reports will show that many of the suggestions contained in the preceding pages are supported by the recommendations of the Commissioners. Subject to certain qualifications, the Commissioners regard the following as essential subjects of elementary education: reading, writing, arithmetic, needlework for girls, linear drawing for boys, singing, English, and object-lessons; and they state that 'some *elementary* instruction in science is only second in importance to the three elementary subjects.' They recommend 'that object-lessons should be continued in the lower standards in succession to similar lessons in the infant school.' They are practically unanimous in recognising the importance of drawing as a subject of school teaching; but as regards manual training they pronounce no very decided opinion, recommending only that manual instruction in the use of tools might often be introduced into elementary schools, but that 'it should not be applicable to boys under ten years of age.' The Commissioners in their report survey the whole field of elementary education, and consequently discuss many debatable matters to which reference would be here out of place.

CHAPTER V.

[illegible] MIDDLE TRADE SCHOOLS

[illegible]

establishment of these schools. The subject was further considered by the Select Committee of the House of Commons, of which Sir Lyon Playfair was chairman, and numerous witnesses have prominently brought the matter under the notice of the Commission appointed to enquire into the working of the Public Elementary Education Acts.[1]

No part of our educational machinery has hitherto been more defective than that which connects elementary with higher education; and it will be well if the demand for technical instruction shall result in such a reorganisation of the curriculum of our middle schools as shall better adapt them to the requirements of scholars who will have to earn their livelihood in some branch of trade or commerce.

In England, there exist already a number of schools, which are intended to give a complete education to children belonging to the lower middle class, and which, as regards their educational rank, are intermediate between secondary and elementary schools. As preparatory to the modern side of our public schools, these establishments may serve a useful purpose; but as offering a complete and suitable training to the children of the better class of artisans, foremen, and small shopkeepers, who have to earn their living,

[1] In the [illegible]

in manufacturing or commercial pursuits, they fail of their object. Their curriculum is overcrowded, and is a compromise resulting from the conflict of too many studies. In many of these schools, boys continue to devote several hours a week in acquiring a smattering of Greek; and Latin is generally regarded as indispensable, in order that the pupils may pass the Oxford and Cambridge examinations. Then, again, arithmetic and algebra are frequently taught, as if the boy would spend his life in solving enigmas; and geometry is made a discipline in logic, the study of which leaves the pupil with a thorough distaste for the subject, and with no practical knowledge which he can apply to the simplest problems he will meet with in his ordinary work. In deference to public opinion, the boy is taught in many of these schools, but not in all, what is called science, and studies chemistry and physics from books, or by aid of lectures, accompanied by the black-board, or, in some cases, by table illustrations, which pass for experiments. He learns a certain amount of French grammar; he can translate a piece of simple French prose into English, but he can neither speak, nor understand when spoken, two simple sentences. Of German he is generally absolutely ignorant. Drawing is still taught from copies of landscapes, or elaborately shaded heads. Some schools have workshops; but in very few of them is there any approach to what may be called *real* practical instruction. It may be thought that I

am exaggerating the defects of some of our intermediate schools; but it is not so. For many years I had opportunities, as examiner, of making myself acquainted with the education given in these schools, and the experience I thus gained, confirmed as it has been recently by further experience, has led me to conclude that the curriculum of these schools must be greatly modified if they are to give to the children of our industrial population a rational and serviceable education.

We often hear an outcry raised against the over-education of the so-called working classes. We are told that the higher instruction contemplated by our School Boards is calculated to make the children of these classes dissatisfied with their lot, and unfit for the work which they will be required to perform; that education takes the artisan out of his proper sphere, and leads him to seek remunerative employment in other walks of life which are already occupied by active workers. There are many persons of considerable practical experience who seriously doubt the advantage of giving any education, beyond such as can be obtained in an ordinary elementary school, to boys who are to be occupied in technical pursuits. They tell us that boys who have come into their works with this higher education are generally less 'smart' than those who have entered at an earlier age, and that the knowledge they have acquired has failed to quicken their intelligence. But this complaint is

really directed, not so much against education itself, as against the education of existing schools. If, however, the education given in these schools were such as to develop the boy's faculties in a practical direction, to give him the knowledge and the skill that would be serviceable to him in productive industry —such knowledge as he would always desire to increase, and such skill as he would be always endeavouring to perfect—then the outcry against over-education would be less frequently heard.

It is to be regretted that, owing to the absence of good middle schools, some of the best boys of the elementary schools of London have been taken from occupations in which their talents and skill are so much needed, and transferred to other pursuits. Until very recently, the few scholarships which the School Board of London possessed have been mainly employed in drafting the most promising pupils from these schools to the public schools leading to the older universities.

The curriculum of studies and the general associations of these ancient seats of learning are not such as to render them the best training schools for the would-be engineer, for the industrial chemist, or for the manager of a factory or mill; and, consequently, it is more than probable that, owing to the absence of good middle schools, these boys have been trained to some professional or literary calling, by which productive and manufacturing industry has

lost the acquisition of intellect it so much needs. A good feature in the schemes of the new Polytechnic Institutions, which promise to exert so beneficial an influence upon the working population of the metropolis, is the arrangement for connecting with them higher-grade day schools, in which selected pupils from the primary schools may be able, by means of scholarships, to continue their education on practical lines.

In considering the most suitable kind of instruction for the children of artisans who are able to remain at school till the age of fourteen or fifteen, we must first of all cut ourselves adrift from the traditions of the old grammar-school system, and endeavour to establish some relation between the education of the child and the career in which he is likely to be engaged. We may take it for granted that in the curriculum of these schools there is neither room nor necessity for the study of Latin or Greek. The children of these schools must be educated, as were the Athenians of old, without the advantage of knowing any dead language. The vernacular proved sufficient, even as mental discipline, for the education of Phidias and of Archimedes, and I see no reason why it should be found wanting in the training of their modern prototypes. The backbone of the instruction to be given in these schools should be mathematics. Of mathematics a boy cannot well know too much. It is applicable at all stages of his work, in the solu-

tion of the most elementary and of the highest practical problems, and without this necessary knowledge the pupil's progress is continually impeded. 'He who knows not mathematics cannot know other sciences,' wrote Roger Bacon. But mathematics should be taught with a view to the possibility of its application; and for this reason Euclid should be banished from the school, or confined to the instruction of the highest classes. The subject next in importance is science, and the branches of science of most value to the technical student are chemistry, mechanics, and physics. Science should be made the chief instrument for the exercise and development of the reasoning and observing faculties. It should be taught rather with this object than for the sake of the information imparted; and, consequently, the success of such teaching should be judged, not so much by the extent of the pupil's acquirements, as by the thoroughness of his insight into the principles and methods by which scientific laws have been established. It always seems to me that it is owing to the absence of the discipline of science-teaching in our public schools that the experienced schoolmaster, feeling the necessity of some equivalent for stimulating observation, attention, comparison, and reasoning among his pupils, has been compelled to apply the methods of science to the teaching of classics, and has therefore attached less importance to the linguistic skill acquired by his scholars than to

the mental discipline which the study has afforded. But although Latin or Greek may thus be made the instrument of scientific teaching, the study of these languages can never do the same for us as the study of any one branch of natural or physical science. It has been said, that 'all learning is scientific which is systematically laid out and followed up to its original sources, and that a genuine humanism is scientific.' Scientific it is, but it is not science; and the argument of the humanists in education seems to me to be faulty in this, that they think that the teaching of scientific method in reasoning about words is an adequate substitute for the teaching of science in observing and reasoning about things.

It is superfluous to say that the schools should be provided with a laboratory, in which the pupils may receive practical instruction in chemistry. Too much importance, however, should not be attached to the scholar's ability to analyse a simple salt. Although qualitative analysis may be made the instrument of sound teaching, it may also degenerate into little more than a rule of thumb process—the mere carrying out of definite instructions. The value of this practical work depends upon the method of teaching adopted, upon the care with which the pupil is taught to observe, and the logical accuracy with which he is trained to reason upon the observations he has made. In the study of physics and mechanics, the pupil should be exercised in practical work, and

the experiments he performs should have for their object the teaching of the methods of observation, which will prove invaluable to him when thrown among the more complex phenomena of after-life.

Much that I have already said about the teaching of science to the children of elementary schools is equally applicable to the teaching of this subject in schools of a higher grade, where better facilities for practical instruction can be provided. Although I have laid great stress on the importance of experimental work in teaching even the elements of physical science, it must not be supposed that the pupil's knowledge of science should be absolutely restricted to those facts which he himself is capable of demonstrating. This would be to overlook altogether the value of books and of oral lessons. Books have their use in the teaching of science as of other subjects, and not only as guides to knowledge, but as means of instruction. Much that a pupil cannot expect to be able to prove for himself he may know through the medium of lectures or books. But such knowledge must be distinguished from that which the student has himself verified. Its value, however, is increased when the pupil, by virtue of the training he has received, is able to understand the processes by which it was evolved, and can estimate the worth of the evidence on which it rests. In science, as in history, it is necessary to accept many facts on the authority of others, and to utilise and build upon

their labours. At the same time, in science as in history, the student should be able to discriminate between the results of actual experiment or original research, and between facts the accuracy of which depends on the testimony of others. Indeed, much of the knowledge obtained from books is correctly described as 'information,' the use and importance of which, however, must not be lightly esteemed; for, by means of such information, the pupil learns a great many facts and methods of which he might otherwise remain in ignorance; and, if properly trained in the methods of scientific investigation, he is able, thereby, to add greatly to his own experience, to see things under a new light, to avoid errors, and so to save time and labour, and in various ways to reap the benefit of others' work. Access to books, therefore, is invaluable to the scientific student, and knowledge so acquired is not to be despised. But without actual practice one cannot learn science, nor can the teaching of the subject be made to yield that rigid mental discipline which constitutes its real value in education.[1]

What I have said about drawing in elementary schools also applies to schools of a higher grade

[1] 'Much interesting and useful information ... [illegible] ... *Commissioners*, p. 142.

The pupils should have the opportunity of further pursuing their instruction in this subject, so that they may be able to discover any latent talent they may possess for art work, and thus determine for themselves their own careers. And modelling should form part of the art instruction, for modelling may be taught, and successfully taught, to very young children. Abroad, the number of technical schools in which this subject is taught is very large. In nearly every art industry it is considered an indispensable preliminary training—in metal work of all kinds, sculpture, pottery, wood-carving, &c. The educational value of this instruction is, no doubt, considerable; and in many of the arts in which boys and girls are likely to be engaged, facility in modelling, as showing the power of appreciating and realising solid forms, is of the utmost service.

It is important that the humanistic elements of education should not be omitted from the curriculum of these schools. It is in the combination of literary with scientific and practical instruction that many foreign schools are so superior to our own. Language and literature may be regarded as indispensable requisites of all higher education. Indeed, I believe the educational value of knowing another language than our own is fully equal to the use it may be to us in enabling us to speak it or to write it. Words occupy in our minds a different meaning, and bear a different relation to the things for which they stand

when we know that the same thing may be expressed by more names than one. For this reason; but still more on account of the undeniable and increasing usefulness in commerce and in industrial pursuits generally, of a knowledge of modern languages, French or German, and, if possible, both, should be included in the course of instruction to be given in such schools. Sound instruction in English is more important in schools in which the curriculum consists largely of science and manual training than where Latin occupies many hours a week of the pupil's time; it should include literature, composition, history, and economics. As regards the value of the study of literature in the future education of artisans I think it necessary to add one word, because I believe that, apart from the pleasure afforded to the pupil by the power to appreciate the writings of great men, and apart from the humanising and elevating influence which the love of good literature is calculated to exercise on the man's life, there is no subject the study of which so well serves to stimulate and develop a boy's imagination, to fill his mind with noble impulses and high ideals, and thus to beneficially affect his modes of thinking, his habits, and his works.

So far, the course of study I have suggested would be common to all pupils of these schools. But beyond this point, in all large schools, particularly in great commercial cities, such as London, Liverpool

Birmingham and Manchester, the principle of bifurcation might be introduced, with a view of giving to the school a commercial as well as a technical character. Boys who have opportunities of entering commercial houses, or who show any special aptitude for languages and business pursuits, should receive special instruction in these schools in commercial subjects; whilst the pupils on the technical side, those who expect to earn their living by the use of their hands —and in all our great manufacturing centres these would constitute the larger class—should have workshop instruction and lessons in machine drawing. The practical work to be done in the shops attached to these schools should be further developed, and should involve the use of other tools than those used in elementary schools. It should give the boy some really valuable constructive skill, so as to form a fitting preliminary to his apprenticeship. Indeed, it has been found that in schools of this grade, in which workshop instruction has been introduced not only have the pupils been eagerly sought after, but the period of apprenticeship has been sensibly reduced. This practical instruction in the shops would vary according to the district in which the school is situated. In our manufacturing towns the instruction would be general, consisting largely of woodwork, and of metalwork at the bench, at the lathe, and at the forge. In other places, practical agriculture might be taught. Where a new industry

has to be created, the teaching might be specialised with the view to a particular trade. In our commercial cities, the pupils of the technical as well as of the commercial department should learn something of the technology of the several raw products, the manufacture of which may form the staple industry of the place, and the scholars should be encouraged to bring specimens to the museum with which all such schools should be provided. In girls' schools, the time set apart for work in the shops might be devoted to dressmaking, cooking, laundrywork, china painting, and other occupations.

It is in the education of foremen that these higher-grade schools are likely to prove of the greatest benefit. In consequence of the extreme subdivision of labour, which often condemns a man for the greater part of his life to the same task, it is becoming more and more difficult, in certain industries, to select competent foremen from the general body of workmen. We are often told that the foreman, like the poet, *nascitur, non fit*; that he is chosen not so much for his superior knowledge or skill as for his innate power of influencing others, for his tact, and other qualities which mark him out for a position of command. But, other things being the same, the better educated workman, who had been trained in such a practical school as I have described, and who, as a boy, had been selected for such training in consequence of his superior intelligence and skill, would have advantages

over his fellow-workpeople which would bring him to the front, and render him more capable and efficient than the man who is scarcely in any way superior to those whom he directs.

It might be well in such schools to arrange the hours of instruction from 9.15 to 11.15, from 11.30 to 1, and from 2 to 5; *i.e.*, six and a half hours daily, of which at least three hours should be spent in practical work. The school course should last three years, children being admitted at about the age of twelve, on the results of a simple examination, or on having passed the fifth standard in an ordinary elementary school. The course of study on the technical side should be practically the same for all pupils in the first and second years; but some specialisation might take place in the third year according to the tastes and capabilities of the pupils.

The hours of instruction for the first two years might be apportioned somewhat as follows:—

Subject	Hours per Week	
	First Year	Second Year
Mathematics and Arithmetic	5	5
Geometry and Mechanical Drawing	$4\frac{1}{2}$	6
Science (Lessons and Laboratory)	$5\frac{1}{4}$	6
English and Geography	$5\frac{3}{4}$	$4\frac{1}{4}$
French and German	3	$3\frac{3}{4}$
Art (Drawing and Modelling)	$4\frac{1}{2}$	$1\frac{1}{2}$
Workshop	$4\frac{1}{2}$	6
Total	$32\frac{1}{2}$	$32\frac{1}{2}$

In the third year about eight or nine hours a week would be given to workshop instruction, and an equal time to laboratory or art work, according to the aptitudes displayed by the pupils. On the commercial side of the school, the time would be differently arranged, more time being given to modern languages and to commercial geography at the expense of the workshop training.

As regards accommodation, the school buildings should comprise a sufficient number of class-rooms, a laboratory; a lecture-room, and a preparation room for chemistry, the same for experimental physics, including mechanics, a school museum, art studios for drawing and modelling, a room for geometrical and machine drawing, a master's room, and the necessary offices for administrative purposes, a shop for woodwork and a shop for metalwork, a dining-room to be used as a general hall, kitchen, &c.

In the girls' department there would be required a room for needlework and dressmaking, and a separate kitchen for lessons in cookery.

These schools might frequently be worked in connection with the evening school for artisans, clerks, and others. The class-rooms, laboratories, and workshops, with possibly some additional accommodation, might with advantage be made available for evening students. An arrangement of this kind exists in many Continental towns, and is now being tried in this country. Here, the day school has been added

to the evening school, often with the view of utilising the rooms during the daytime; but it is important that the efficiency of the day school, both as regards teaching staff and teaching accommodation, should not be in any way sacrificed to the necessity of meeting the requirements of evening students.

Intermediate schools, such as I have described, ought to be placed within the reach of the better class of artisans, of foremen of works, small manufacturers, and small shopkeepers. The fees ought to be such as persons in what is called the lower middle class of society could afford to pay. They should not be so high as to place the instruction beyond the reach of such people, nor so low as to give to the education a too distinctly eleemosynary character. Considering the prevailing feeling in this country, that persons able to pay for the education of their children should not avail themselves of the instruction given in the public elementary schools, most of these intermediate schools of which I am speaking might have a junior department attached to them, for the children of parents capable of paying fees in excess of the maximum fee chargeable by the School Board. If intermediate education were under the direction of the State, there would be no difficulty in the establishment of such schools; but as School Boards throughout the country are unable to earn grants, and at the same time to make a higher charge than *9d.* a week, a difficulty presents itself. For the edu-

cation given in these schools would be largely sought after by parents willing and able to pay higher fees, and it would be in opposition to the best interests of the school to exclude this class of children from its benefits. The admixture of the poorer, but in some cases more gifted, children of public elementary schools with other children having a higher standard of living, and occupying a somewhat better position in the social scale, would tend to improve both classes of pupils, and would give a good tone to the school work.

In what way the means may be found for the establishment of these schools without State aid, it is difficult to say. If any endowments still exist which were originally intended to provide elementary education, now no longer needed, for poor children, they might be utilised in this direction. Private generosity might step in and help to set such schools afloat, as has been done in the case of some of the existing middle schools for boys. Again, some of these schools might adapt their curriculum to the requirements of the industrial classes, and help to fill up this great lacuna in our educational system. But if no endowments can be found available, if public enterprise will afford no aid, and if existing schools continue to cling to the traditions of the past, then I think it will become necessary for the School Boards, or other local authorities, to provide suitable instruction for the selected children of the public elementary

schools; and if, as certainly will happen, the children of a somewhat wealthier class avail themselves of this rate-aided teaching, it seems to me that it is better that a few persons who can afford to pay should accept eleemosynary instruction, than that hundreds and thousands of promising children should go without it. But both on moral and on social grounds, and for the assistance that would be thus afforded in the maintenance of these schools, it would be well if the maximum school fees in these higher elementary schools could be raised from 3*s.* to 6*s.* or 8*s.* per month. It may be said that I have grouped together, without distinction, higher elementary and middle-class schools. I have done so because I can see no reason, beyond one resting on very insufficient social grounds, to separate them. Such schools might be made to serve for those who can, and cannot, afford to pay for their own education. The School Board or local authority should be empowered to pay part or the whole of the fees of the deserving children drafted by competition into the higher schools; and, in certain cases, the most needy of the children should receive scholarships to help towards their maintenance, and to compensate their parents for the loss of the children's early earnings. These scholarships might be of rising value—say 12*l.* for the first year, 13*l.* for the second, and 15*l.* for the third year. The expenses of the maintenance of schools having no endowment would be defrayed partly by fees, partly by the grants

obtained from the Science and Art Department, and by funds provided out of local rates for technical schools.

From what I have said, it will be seen that I am inclined to agree with those persons who consider that this higher instruction should be given in separate schools, into which the selected pupils of the ordinary elementary schools would be drafted. It must be remembered that the necessary teaching appliances in intermediate schools such as I have described are somewhat costly, but that, when they are adequately provided, they serve for the education of a larger number of children than are likely to be able to avail themselves of such advanced instruction in any one school. Indeed, one such school would serve to gather together the more promising pupils from twenty-five or thirty of the surrounding elementary schools of a lower grade.[1] Moreover, I think it a waste of national strength to over-educate, at the country's expense, the dullards of a school. There must be hewers of wood and drawers of water to the end of time. What we have to see to is that, whilst we send out into the world, adequately equipped with

[1] [illegible] *Commission*, p. 308.

knowledge, the rank and file of our children, to occupy the lower rungs of the great industrial ladder, we lose no opportunity of selecting the children of special aptitudes and brighter intellects, and of training them for higher posts, so that there may not be lost to the industry and commerce of our country, which so greatly needs their aid, a spark of genius nor a stroke of skill.

Of schools giving an education somewhat on the lines that I have indicated there are some few examples in Great Britain. Of these, one of the most successful, perhaps, is the upper department of the Central School at Sheffield. This school has nearly 800 pupils, and the total cost of maintenance is very little more than 3,000*l.* a year. Manchester, Birmingham, Nottingham, Bradford and Keighley, and other towns have schools of different grades, which are intermediate between the Elementary School and the Technical College; but many of these suffer from a want of funds which prevents their free development, and they find their course of study fettered by the conditions under which alone grants may be earned from the Education and the Science and Art Departments. In London, we have the United Westminster School, and the Cowper Street School, which latter may be regarded as the pioneer of middle schools, affording to its pupils the opportunity of specialising their studies with a view to commercial as well as to technical pursuits.

But the best examples of these schools are found abroad, and particularly in France, where a very complete system of higher elementary education exists.

In France, nearly every large town has its *école primaire supérieure*, in which the instruction is gratuitous, and is organised on lines very similar to those above indicated. A full description of these schools will be found in the Report of the Royal Commissioners on Technical Instruction.[1] In most of these schools nine hours a week are given to literary instruction, including the French language, nine hours to scientific instruction, four hours to modern languages, three hours to drawing, four hours to workshop practice, and one hour to singing. One of the first founded was the *Ecole Martinière* at Lyons, to which reference has already been made.[2] In Paris, there are the *Ecoles Turgot*, *Colbert*, *Lavoisier*, *Say* and *Arago*, attended by 3,163 pupils. A more recent school of a somewhat similar kind is the *Ecole Professionnelle Municipale* of Rheims. This school was established in 1875, in order to impart to the youths of Rheims special knowledge of their own manufactures, and to train them for the requirements of trade and commerce. The leading industries of

[1] For later particulars, and in some cases [illegible] part of a *Report on* [illegible], by J. Schoenhof, Washington, 1888.

[2] See Chapter III., p. 58.

Rheims and of the neighbourhood are the woollen trade, the wine trade, and commerce generally. The technical instruction has special reference to these occupations. The school contains, in addition to the ordinary lecture theatres and class-rooms, good chemical laboratories, weaving and spinning sheds, fitted with machinery of the most recent construction, workshops for wood and iron, furnished with a steam-engine, and with the necessary hand and machine tools, and rooms for drawing. The boys are not admitted under twelve years of age, and are required to pass an elementary examination, or to produce the leaving certificate of the primary school.

The school consists of three departments—a technical, an agricultural, and a commercial department. In the technical and agricultural departments the course lasts three years, and during the first two years the instruction is the same for all, whilst in the third year the workshop and laboratory teaching is specialised according to the requirements of the pupils. For the agricultural pupils, there is a special chemical laboratory, in which pupils of the third year study the chemical composition of earths, waters, and of the principal food-stuffs.

The school buildings consist of a principal building facing the street, which contains the ordinary class-rooms, drawing-rooms, and offices, the museum and the weaving workshop. In the rear, are two

wings, 120 feet by 33 feet, one of which contains the engineering workshop and the other the chemical and physical laboratories and lecture-rooms. Besides the laboratory for agricultural pupils, there are two others with places for 80 and 50 pupils respectively. Before the passing of the Public Elementary Education Act of 1881, the fee for day pupils was 4*l.* a year; but since 1881, the instruction at this school, and at all other similar higher elementary schools in France, has been gratuitous.

The school has accommodation for 100 boarders, who are charged 30*l.* a year; but there are about forty bursaries, which cover the expense of boarding and provide free education. According to the Budget for 1884–5, the annual expense of maintenance was 2,698*l.*, of which 1,880*l.* was contributed by the State, the remainder by the municipality. The erection and equipment of the school cost about 24,000*l.*

From the subjoined time-table it will be seen that in the industrial department a large amount of time is given to drawing and workshop instruction, and a corresponding number of hours to modern languages in the commercial department. Latin is not taught; but three hours a week are devoted to Spanish, which is seldom or never taught in any of our own schools although it is scarcely less useful to the mercantile traveller than German. The importance of manual training, as a part of general education, is recognised

by giving two hours a week to it in the commercial section. The hours of instruction are much longer than would be tolerated in an English school; but it must be remembered that workshop instruction affords a distinct relief to purely literary teaching.

Subject of Instruction	Industrial Schools			Commerce	
	First Year	Second Year	Third Year	First Year	Second Year
French	5	3	2	3	2
German	4	3	2	6	6
English	4	3	2	6	6
Spanish		—	—	3	3
History	2	2	2	2	2
Geography	2	2	2	2	2
Law	—	—	2	2	2
Political economy		—	2	2	3
Bookkeeping and office work		2	2	6	10
Mathematics	5	5	5	5	2
Physics	2	2	2	2	2
Chemistry	3	4	4	2	2
Natural history	1	1	—	1	1
Workshop, including weaving	6	8	14	2	2
Ornamental drawing	—	2	2	2	2
Industrial drawing	6	6	8	—	—
Singing	1	1	1	1	1
Gymnastics	1	1	1	1	1

CHAPTER VI.

A FOREIGN INSTANCE OF SCHOOL SYSTEM—EDUCATION IN BAVARIA.

As an example of school organisation in Germany, I have selected the Bavarian system—not because it is better than the school systems of Prussia or of Stuttgart, with which it has many points in common, but because it has been less frequently described, and presents a fairly complete system, well adapted to the needs of an industrial people.

The first thing that strikes the observer in comparing German and English education is the better organisation and gradation of the foreign schools. What the Germans call *Schulwesen* scarcely exists in England. This is mainly owing to the fact that for many years education in Germany has been under State control, whereas in England it is only recently that the State has, to any considerable extent, interfered with the education of the country, and even now, that interference is restricted to the instruction in elementary and evening schools. There are, of course, advantages both in the systems of Germany

and of England. Where the schools are all under the supervision and the direction of the State, improvements are more readily introduced into the methods of instruction than where no such control exists. On the other hand, the freedom of instruction and the great variety in the types of schools which we find in England present features which are favourably regarded by those who are compelled to work in accordance with a rigidly defined programme. Nothing, however, is more difficult than the endeavour to classify English schools. As regards the elementary schools, there is, of course, no difficulty, because they are all organised on the same plan; but as soon as we proceed one step higher in the educational ladder the difficulty of presenting in a tabular form the various grades of secondary schools is very considerable. On the other hand, it must not be supposed that although our secondary education is free from Government control it is therefore wholly unfettered by external influences. Of late years, the universities have assumed, to some extent, the position occupied by the Governments of foreign countries. Secondary education in England is very much influenced by the examinational systems of the universities, and the necessity of preparing pupils for the different local and matriculation examinations limits free teaching almost as much as State inspection. Indeed, I am not certain but that the Germans would prefer that the general outlines of their instruction should be defined by a

superior authority, than find themselves obliged to prepare pupils for various examinations and judged to a very great extent by the results. But where the foreign system seems to me to be undoubtedly superior is in the closer definition of the objects which each school endeavours to fulfil. In England, social distinctions have more reference to the classification of schools than the relation of the teaching to the future career of the pupil. This is not so on the Continent. The consequence is that in England nearly all schools, except the primary, aim at teaching the same subjects, and have a very extensive curriculum, adapted to the requirements of pupils with very different objects in life. Where all the schools are controlled by one central authority this is not the case, and whilst the number of subjects taught in each school is more restricted, the curriculum is made to depend upon the age at which the pupil leaves, and, to some extent, upon his future career. More time can thus be devoted to each subject, and the teaching is more thorough.

Another defect in our own school system, arising from want of organisation, is that different schools, which ought to aim at educating different classes of pupils, overlap one another in their aims and objects, and are with difficulty distinguishable. Parents, consequently, in selecting the school to which they shall send their sons, are less influenced by the kind of education which that school provides

than by the social position of the pupils attending it. This overlapping of instruction increases the expense of school teaching quite as much as it lessens its efficiency. Moreover, modifications in the system of instruction and in the methods of teaching are less readily adopted where schoolmasters are compelled to follow rather than to lead public opinion, and educational progress is less rapid than when a central board guides and controls it.

In Germany, technical instruction commenced with the highest and not with the lowest grade of education. Its influence has spread downwards. The first persons technically educated were the masters and not the men, and the first efforts of the State were directed towards the establishment, as separate institutions, or in connection with the universities, of special schools for teaching the higher branches of science and the application of science to industry. The Germans believed that the best way of improving the technical knowledge and skill of the intelligent workman was to commence by educating those who had to guide and direct him.

There is probably no country in the world in which national prosperity has been so clearly indebted to education as in Germany. Generally, education follows, and at a great distance, social changes, but the Germans owe it to the wisdom of their rulers that this was not the case in their own country. The great expansion of the empire, and the growth and

development of native industries, are largely due to the excellent system of education which they have gradually established.

When Germany was divided into a number of petty states, and its political influence counted for little, it was regarded as the natural home of the schoolmaster and the professor, and the excellence of its educational institutions attracted students from all parts of Europe. Few persons then realised the influence which the increasing culture of the people would, before long, exercise on the destinies of the nation. The different states of Germany were at that time constantly endeavouring to rival one another in the excellence and perfection of their schools and colleges. In the place of a land greed there was a culture-greed. The distinguishing feature of the teaching in all their schools was *thoroughness*, a feature which had its effect not only on the intellectual but also on the moral character of the people. To the lessons learnt in school has been due much of the assiduity, the perseverance, the devotion to duty, and the power of work, which have enabled Germany to succeed as a nation, and individual Germans to prosper in competition with foreigners in nearly all parts of the world.

A typical example of the organisation of German schools is presented in the school system of Bavaria. This system is well illustrated in the city of Munich, which contains [illegible] of many of the different

schools existing throughout the country. I first became acquainted with the Bavarian system of education during a visit paid to Munich and Nuremberg in the spring of 1882, in company with my colleagues, the members of the Royal Commission on Technical Instruction. At our request, Dr. Bauernfeind, the Director of the celebrated Polytechnic School of Munich, prepared for us the annexed diagram (see p. 199), which gives a general view of the Bavarian school system. During the spring of the year 1887 I again visited Bavaria, with the view of verifying and supplementing my former experiences.[1]

The population of Bavaria is about 5,420,000, and in 1885–86 there were 7,131 elementary schools, attended by 855,463 children, or two in fifteen of the population. The population of Munich is about 262,000, and it contains twenty schools, the average attendance at which is nearly 28,000 children, or one in nine of the entire population. The smaller proportion in the capital is due to the fact that in Munich, a larger number of children are privately educated, or leave the elementary schools at an earlier age to attend some higher school. The ordinary elementary school age is between six and thirteen. The education is compulsory and nearly

[1] Many of the statistics contained in this chapter have been taken from *Die Ergebnisse der Unterrichts-Statistik für das Schuljahr* 1884–85, by Carl Rasp. For later facts and other suggestions I am indebted to Dr. Bauernfeind, to Mr. Drummond, H.M.'s Chargé d'Affaires, and to Mr. Cadogan, Secretary to H.M.'s Legation, at Munich.

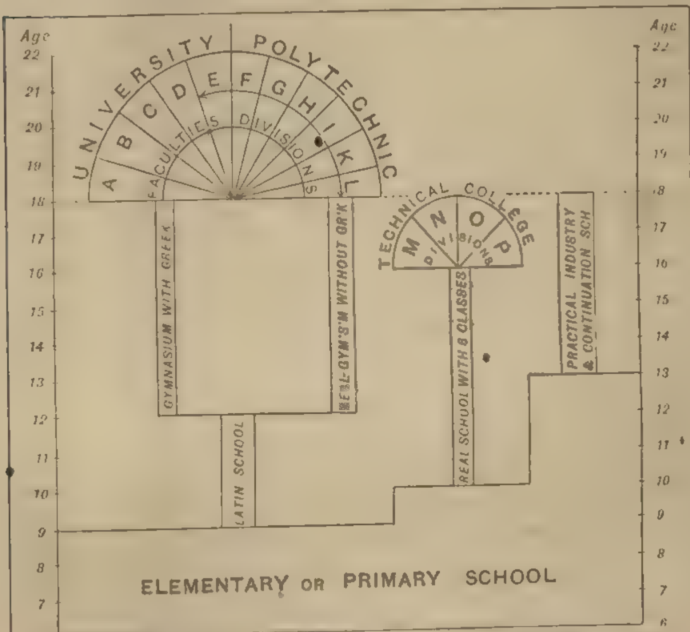
everywhere gratuitous. The cost is borne partly by the State and partly by the locality, and amounts to about 640,000*l.* a year.

By reference to the diagram, in which the age of the pupil is indicated by a scale on either side, it will be seen that children leaving the primary school at the age of thirteen pursue their studies in a 'continuation school,' which they must attend for three years and may attend for five years. These continuation schools are held on the evenings of the week days and on Sundays and holidays. The instruction consists of the same subjects as are taught in the primary school, further continued, in addition to elementary science, bookkeeping, and what may be called industrial drawing.[1] In 1885–86, throughout Bavaria there were 244 such schools attended by 26,645 students, in which 1,300 teachers were employed. In Munich only, the attendance in these schools averages 3,907 yearly.

Besides these continuation schools, which are known as *Gewerbliche Fortbildungsschulen*, there were, in the year 1884–85, 550 *Landwirthschaftliche*, or agricultural continuation schools. In these schools, the subjects of ordinary elementary instruction are continued; and, in addition, lessons are given in various branches of agriculture, and in matters relating to the rearing of cattle and to farming opera-

[1] 'They desire to learn what will be of use to them. Give them, [illegible] drawing, modelling, [illegible] and they will attend the evening school.' [illegible] p. 162

tions. In some of these schools courses of instruction are given during the day The number of pupils



UNIVERSITY FACULTIES.	POLYTECHNIC DIVISIONS.	TECHNICAL COLLEGE DIVISIONS.
A. Theology.	F. General.	M. Mechanics.
B. Jurisprudence.	G. Engineering.	N. Chemistry.
C. Cameralistic.	H. Architecture.	O. Building.
D. Medicine.	I. Mechanics.	P. Commerce.
E. Philosophy.	K. Chemistry.	
	L. Agriculture.	

attending these schools in the session 1884-85 was 9,961, and the number of teachers was 899. In very

few localities is any fee charged for attendance, the whole amount of fees received in one year not exceeding 26*l*., against an annual expenditure of 6,977*l*.

The elementary schools are attended by the great majority of the children of the country, be the social position of their parents what it may; and the idea that such schools are for the children of the poor only, and that those who contribute most to their support have no right to take advantage of them, certainly never occurs to a German mind. They are essentially *Volksschulen*, or people's schools. Many of those who are intended for higher education leave the elementary school at the age of ten, and proceed to the *Realschule*. Into this school they are only admitted on passing an entrance examination. The fees are about twenty-five shillings a year, but a large number of the children are admitted at half-fees or quite gratuitously. In Bavaria there are about forty-six such schools, in thirty-four of which the course of study occupies six years, and in twelve four years. Besides these, there are the private schools of the same kind. The children enter at the age of ten, and leave at the age of fourteen or sixteen. The course of instruction comprises German, at least one other modern language, science, mathematics, geography and history, and drawing. Latin is not taught, nor is there any workshop instruction. They are distinctly higher elementary schools, giving that kind of

general instruction which will be most useful to those who will enter manufacturing or commercial life at the age of sixteen, or who may be preparing for a course of technical instruction with a view to some higher post in industrial works.

The only school of this type I visited was situated in the Eisenmanns-strasse, and contained about seven hundred pupils, divided into six classes. The school is well provided with apparatus for practical scientific instruction. It has a good chemical laboratory, in which boys of the fifth and sixth classes receive instruction for about three hours per week. There is a good lecture theatre, with a preparation-room attached to it, and a private laboratory for the master. One or two rooms were occupied with collections of scientific objects. There is a mineralogical museum, and a well-arranged cabinet of physical apparatus, besides the apparatus needed for chemical instruction. The lessons in physics consist almost exclusively of oral teaching in the lecture theatre, illustrated by experiments; the note-books of the pupils being carefully examined and marked by the instructor.

Laboratory instruction in physics, in which the pupils themselves are exercised in practical work had not, at the time of my visit to Germany, been introduced into any of the schools. The class-rooms of the school are well supplied with maps, diagrams of mechanical and physical apparatus, as well as of the different parts of plants and insects. The teach-

ing of natural history forms an important feature in the school curriculum, and is illustrated by an excellent collection of models of flowers. Besides these diagrams and models, which are freely employed as aids to the teaching given in this school, part of the courtyard is used as a garden, in which plants are grown to illustrate the botanical lessons. I may here mention that the teaching of botany is an essential part of the scientific instruction given in nearly all the *Realschulen* of Germany, and precedes the teaching of physics and of chemistry, as exercising the observing rather than the reasoning faculties of the children. Similar schools in Berlin, one of which I recently visited, are supplied once or twice a week from the Royal Botanical Gardens with fresh specimens of flowers for the instruction of the pupils. In the Munich school, natural history is taught to the pupils of the second and third classes, physics and chemistry to those of the fourth, fifth, and sixth.

The standard of mathematical teaching in these Real-Schools is high, and the teaching of geometry is facilitated and rendered more directly serviceable to the pupil by not insisting on the use of Euclid as a text-book. In the school I am describing, there was a good collection of models, illustrating the different geometrical forms, and the intersection of surfaces. Geometry is taught together with drawing, so as to prepare the way for the teaching of mechanical drawing, excellent specimens of which were submitted to

us. There is also in the school a good studio, furnished with casts, in which the pupils receive instruction in freehand and in model drawing.

In the year 1884–85, the total number of boys in attendance at these schools was 8,076.

By reference to the diagram it will be seen that pupils leaving this school at the age of sixteen are admissible, and some of them proceed, to the Technical College, which is known in Bavaria by the name of *Industrie-Schule*. The number of students for the session 1883–84, in the four technical colleges found in Bavaria, was only 370, the school in Nuremberg being the best attended. The total annual cost to the State for the maintenance of these schools is about 11,300*l.*, the cost of the education of each student being about 30*l.* a year. This corresponds very nearly with the cost of the education of the day students of the Finsbury Technical College.

The aim of these schools is to enable the students to obtain a practical education, less theoretical in character than that given in the universities or at the polytechnic schools, which shall fit them to enter upon commercial or industrial work, with a fair chance of immediate employment, and of obtaining steady promotion in their careers. Those students who are not admitted by exhibitions pay an entrance fee of four shillings, and thirty-six shillings per annum, or twenty-two shillings for the half-year. The school course lasts two years. There are four

divisions, according as the student is intended for engineering, chemical, building, or commercial work. Like all the educational institutions of Germany, the school is well provided with apparatus, specimens, and collections. It contains a room replete with mechanical models of nearly every description, including pumps, valves, steam-engines, and hydraulic apparatus, beautifully constructed and showing the working of the different parts. There is also an art studio, well fitted with casts; and screens are carefully arranged between the windows so as to produce proper effects of light and shade. A point worthy of note is that the smaller casts are kept in cabinets with glass doors until they are required for use, so as to prevent their being discoloured by dust, which often interferes with the student's perception of natural shade. In this college considerable attention is paid to the teaching of mathematics and of machine drawing; and in the chemical laboratory, besides quantitative and qualitative analysis, the students spend a large amount of time in synthetical chemistry, and the museum attached to the laboratory contains a number of substances prepared by the students.

A special feature of the instruction in these colleges is that given in the workshops. Workshop instruction has only of late years been given in the technical schools of Germany, and the opinion is still very generally held throughout Germany that practice in the use of tools is best commenced in the

commercial works, and that the period devoted to school education should be wholly occupied in the teaching of principles. 'Die Praxis,' they tell us, 'kommt bald genug.' There is, however, a gradually increasing tendency to adopt the opposite view; and the importance attached to workshop instruction in other countries, notably in France and in the United States, is not without effect on German educationists. In Austria, workshop schools are numerous, and in Rhenish Prussia the number of such schools is increasing.

In each of the four technical colleges of Bavaria there are workshops. In the Munich school, the workshop is fitted with thirty-six vices, two planing machines, ten lathes, two upright drills, the power being supplied by a two horse-power gas-engine, and a six horse-power steam-engine. The instruction is obligatory on all students in the engineering section, but is voluntary for those in all other divisions. Each student has his own box of tools, which is fitted to the wall above the benches and kept under lock and key. The steam engine is tended by the students, each one taking charge of it for a week at a time. The workshops are under the direction of a practical scientific mechanic, and no extra fee is charged for this kind of training. Many of the machines used in the shops have been made by the students.

The opinions which we received from different authorities, as to the value of these schools, varied

very much. More than one of the professors of the university attached very little to the instruction. On the other hand, the testimony of managers of machine works in Bavaria, who had had the opportunity of testing the results of the training given in these *Industrie-Schulen*, is very much in favour of the education they provide. An English foreman, engaged in the works of a large machine-maker at Nuremberg, referred to it in the highest possible terms, and distinctly stated that he gave a decided preference to boys who had received during their school course some amount of workshop instruction. We ourselves came to the conclusion that in those technical colleges in which workshop instruction formed a part of the curriculum, the machine drawing was generally much better than in other schools, where no such instruction was given.

In Bavaria, as in other parts of Germany, are found a number of schools especially intended for the instruction of apprentices and workmen engaged in different branches of the building trade. These schools are known as *Baugewerkschulen*. The schools are open during the winter months only, from November to March, when, owing to the prevailing frosty weather, all building operations are to a great extent suspended. In Bavaria there are five such schools attended by 650 students. For admission into these schools the pupils must be at least sixteen years old, and must already have had two years'

practical experience at some branch of the trade. The course of instruction lasts four semesters, and includes German, arithmetic, bookkeeping, mathematics, freehand drawing, elementary science, modelling, stereotomy, the principles of building construction and of architecture, the nature of building materials, &c. At the schools in Munich and Nuremberg, examinations are held, to which all students who have completed their four years' course are admitted. Although the instruction given in these schools is mainly theoretical, it is distinctly professional, and is specialised with a view to the exact requirements of those who receive it. The instructors are, in all cases, practical men thoroughly acquainted with the subjects they profess to teach.

Besides these schools, in which the instruction is more or less of a general character, there are found in Bavaria 19 *Fachschulen*, or special trade schools, with an attendance of 2,923 students. Some of these approach most nearly to the apprenticeship schools of France and to the trade schools of Austria. They include schools for instruction in weaving, pottery, wood-carving, brewing, and in drawing, painting, and modelling.

In Bavaria, children who are intended to receive a higher secondary education, which shall extend to the age of eighteen, leave the primary school at nine years of age and enter a first-grade classical school, or a modern school. These schools, to which reference

has already been made, constitute a characteristic feature in German education. It is pre-eminently, perhaps, in secondary education that the Germans have been for so long a time in advance of all other people. The late Mr. Matthew Arnold, in his 'Higher Schools and Universities in Germany,' published in 1868, first made us fully acquainted with the system of instruction adopted in these schools. The organisation of these secondary schools is the subject of constant discussion in educational journals and in educational societies in Germany; and in no two states is the system of instruction pursued absolutely identical. The question as to the age at which Greek should be commenced determines to some extent the character of the instruction given in these schools. In Bavaria, the classical and the modern secondary school are respectively known as the *Humanistic-Gymnasium* with Greek, and the *Real-Gymnasium* without Greek. In the former, as will be seen from the diagram, the study of Greek is commenced at the age of twelve. The three junior forms, in which Latin only is taught, are common to both schools. The advantage of this system is that the child is not required definitely to choose between the literary and the more scientific education until he shall have reached an age at which his taste and aptitude can be more readily determined. If he has already entered the *Gymnasium*, where Greek is taught, he can leave it at the age of twelve, should his parents desire him to do so, and continue

his studies in the *Real-Gymnasium*, where he will pursue his Latin, but will learn no Greek; and if he has entered, in the first instance, a *Real-Gymnasium*, he can pass out of it into the classical school, without any break whatever in the continuity of his studies. It is interesting to note that the head masters of three of our principal public schools have issued a circular bearing date July 1887, in which they suggest that Greek shall not be taught in the preparatory school, or *Pro-Gymnasium*, and shall not be begun before the age of twelve.

The *Real-Gymnasium* corresponds very nearly with the modern side of English public schools. At one time, there were six schools of the *Real-Gymnasium* type in Bavaria. But, owing to the gradual falling off in the attendance, the number of these schools has been reduced to four, in Munich, Nuremberg, Wurzburg, and Augsburg. In the year 1884, the number of pupils in these four schools had fallen as low as 426, the reason assigned being, that the leaving examination from these schools does not admit the pupils to any one of the four professional faculties of the university A, B, C, or D, in which, of late years, the attendance has considerably increased. The cost to the State of the maintenance of these schools for the year 1884 was about 9,000*l*., or over 21*l* per annum for each scholar. On the other hand, the attendance at the humanistic or classical schools has of late increased, and is very large in proportion to the popu-

lation. Some of the *Gymnasia* have not their full complement of classes. These are called *Pro-Gymnasia*, or preparatory schools. They have only the five lowest classes. Of such schools there are 44 in Bavaria, with an attendance roll of 3,089 pupils. Of complete *Gymnasia* with nine classes there are 33, at which the attendance for 1884 was 14,069. Many of these classical schools are supported, as in this country, from funds derived from ancient endowments. But the State contributions to the maintenance of the schools amounted in 1883–84 to 109,000*l.*, the cost of the education of each pupil being about 10*l.* per annum.

Of the entire male population of Bavaria, 2,639,242 (December 1885), about 32,646 are receiving a secondary education in one or other of the schools already referred to, in addition to those who are being educated in the specially commercial schools.

There cannot, of course, be too much variety in the different classes of schools, provided their aims and objects are well defined, to which parents may send their children; and for this reason it is well that the *Real-Gymnasium* should exist side by side with the more strictly classical school. But there can be little doubt that, if any really valuable instruction is to be given in Latin, the time devoted to it in the *Real-Gymnasium* must be such as seriously to interfere with the requirements of mathematical and scientific teaching; and the practical teaching of science de-

mands more time than can be given to it if Latin is to form part of the school curriculum. For this reason, in Prussia and in the northern states of Germany, the curriculum of the *Realschule*, in which no Latin is taught, has been extended, and additional classes have been added to it, so as to make it correspond in grade with that of the classical and modern schools. Schools of this kind, in which there are ten classes, as in the *Gymnasium*, are found in Berlin and in many other cities in Germany; and it is probable that the distinction between a literary and a scientific training will gradually become more and more pronounced, and the choice will lie mainly between the training of the classical and of the purely scientific school. The figures above quoted show that this is likely to be the case, and as science comes to be more practically taught, the necessity of lightening the curriculum of modern schools by the omission of Latin will be more generally recognised. In the Bavarian system of education, the *Realschule* has not a full complement of classes, and is distinctly of a lower grade than the *Realschulen* of North Germany generally. Indeed, it is intended mainly for those children whose position is such as not to enable them to take advantage of the opportunities of the higher education of the universities or of the polytechnic school.

In Bavaria, as in other parts of Germany, the higher secondary schools are the channels through

which students pass to the university or to the polytechnic school. The classical training of the *Gymnasium* is still inferentially regarded as the highest type of education, and the pupils leaving this school with the matriculation certificate are at once admissible into any of the several faculties of the university or of the polytechnic. But this is not so with those who have passed through the *Real-Gymnasium*, which answers to the modern side of our public school. The leaving certificate of the *Real-Gymnasium* does not qualify them to continue their studies at the university in the faculties of law, theology, or medicine. This is indicated on the diagram by the circular arrow which, starting at the *Gymnasium*, extends from A to L, and, starting from the other side, from L to E.

Before leaving the subject of German secondary schools, a few words should be said about commercial schools, because they occupy a position somewhat outside the general school system. In Bavaria there are eight commercial schools, of which the more important are at Munich, Nuremberg, and Marktbreit-am-Main. Those at Munich and Nuremberg I visited in 1887. The education is very similar in all. The programme of the Munich school clearly states that the purpose of the school is to 'afford to its pupils a higher general education for *das burgerliche Leben*, and a special preparation for a mercantile calling;' and it goes on to show how, by

the exclusion of Latin from the curriculum, *thoroughness* is obtained for instruction in those subjects which exert a great influence on the practical affairs of modern life.

The Munich school has six classes, and children enter between the ages of 10 and 12 with the acquirements of the fourth class of the elementary school. The curriculum comprises mercantile arithmetic, bookkeeping, and commercial science. In all the subjects of instruction a *bias* is given to the future mercantile needs of the pupils, and it is mainly in this respect that the instruction differs from that given in the ordinary *Real* schools. I cannot say that I was favourably impressed by these schools. It seems to be an undoubted fact that the pupils easily find places in business houses, and this accounts for the comparatively high fees (7*l.* 10*s.* per annum) which seem to be willingly paid by parents for the education of their children in these schools. From what I heard, however, and from what I saw of the education they afforded, I did not think that these schools were likely to increase in number. The attendance, however, continues satisfactory. In 1884–85 there were 1,111 pupils in these schools, which is about 3·5 per 1,000 of the male population of Bavaria.

The German university is an institution in many respects similar to University College and King's College, London, and to Owens College, Manchester,

but on a much more extensive scale. It corresponds more nearly with a Scotch university than with that of Oxford or Cambridge. It is at once a teaching and a degree-conferring body, with faculties of instruction covering the whole area of human knowledge except the application of science to the several branches of engineering. The University of Munich consists of five faculties—those of theology, law, medicine, philosophy, and what, for want of a better title, may be called the civil service or commercial faculty. The philosophical faculty comprises all branches of what is generally understood by philosophy proper, including logic, psychology, metaphysics, and the history of philosophy, as well as the whole range of the natural and physical sciences. For many years past, the science faculties of the German universities have been more completely organised than those of any other country. The University of Munich is specially distinguished for its chemical teaching. The laboratories, under the direction of Professor Baeyer, are very extensive, and have been erected by the State at a cost of about 30,000*l.*, and were, till very recently, the best equipped of all the laboratories of Europe. They consist of four large laboratories for qualitative and quantitative analysis, and for the study of organic and inorganic chemistry, besides several smaller laboratories in which teachers and students are occupied with original research.

To the chemical laboratories of the universities Germany undoubtedly owes much of the success of its manufacturin gindustry. Although the polytechnic institutions are essentially schools for the training of those who are intended for technical pursuits, the education provided in the universities has exerted considerable influence on the development of productive industry in Germany. By means of their research laboratories the universities have done much to add to the store of human knowledge, and to train men in the methods of discovery. The legion of professors and of subordinate teachers attached to these higher schools, all striving to push science beyond its present limits, and to force nature to reveal fresh secrets, are virtually enrolled in the service of trade and commerce. In chemistry, in physics, in mechanics, and in biology, the teachers in the universities of Germany have been foremost among those whose researches have led to important discoveries that have materially added to the wealth of the country. Indeed, it is essentially in the extent and in the general diffusion of the higher education, in its accessibility, and in the appreciation of its importance by all classes, that the German people are so much ahead of us. Prussia is said to spend 391,000*l.* yearly out of taxation on her universities alone, and looking to the great development in the last few years of trade in Germany, there can be no doubt that the German nation has done wisely in

making this ample provision for the higher scientific and technical instruction of the people.

The principal chemists of Germany have been trained in the universities, and there has been a constant rivalry between the chemical teaching of the universities and of the polytechnic schools, the former being generally regarded as the more advanced, and the latter as the better adapted for the training of those who are not intended to be mere analysts, but masters or managers of chemical works. The relative advantages of the university and of the polytechnic, as a school for the education of industrial chemists, is one of the many educational points which cannot yet be considered as definitely settled. Indeed, the whole question of the relation of the university to the polytechnic school is full of difficulty, some eminent authorities being in favour of the combination of university and of technical teaching, whilst others think that the study of pure science and the cause of the higher learning would suffer from the too close association of the university and the professional school. Into this vexed question I do not propose to enter, but refer my readers to pp. 207–216 of the first volume of the Commissioners' Report on Technical Instruction, in which the subject is fully discussed. This only I will say, that whilst such a fusion cannot in any way affect the efficiency of the technical teaching, provided the supply of funds is adequate for the maintenance of the general as well

as of the special schools, the introduction of a commercial element into the instruction is likely to alter the aim and purpose of what is generally understood by university teaching; and for this reason, if for no other, the German system has much to recommend it. At the same time it must be remembered, as pointed out in the opening chapter, that from the earliest times professional schools have formed parts of the university; and there can be little doubt that if the organised knowledge we call science had existed eight centuries ago, and if its application to engineering, architecture, agriculture, and productive industry generally had been as well understood then as now, a faculty of applied science would have been added to the faculties of law, medicine, and theology, and the technical high school would have been included in the university.

In Bavaria, besides the University of Munich, there are two other universities, the one at Würzburg and the other at Erlangen. They are supported by ancient endowments, the incomes from which are supplemented by subsidies from the State. In the year 1884-85 the sum expended on the three universities was 104,517*l.*, towards which the State contributed 73,718*l.* The number of students in the year 1885-86 was 6,341, distributed as follows: 3,835 in Munich, 1,580 in Wurzburg, and 926 in Erlangen. Of these, 5,549 were matriculated. The attendance at the universities is steadily improving.

In addition to the theological faculties of the universities there are in Bavaria seven *Lycées*, or training schools for the profession of theology. These are attended by 637 students. In Germany it is not uncommon to find 'special' schools in some professional or trade subject, in which higher instruction is given supplementary to that of the university or polytechnic. The weaving and dyeing school of Vienna is an example of such an establishment.

In Munich, side by side with the university, exists the well-known polytechnic school, for instruction in science in its application to industry. This institution is co-ordinate with the university, and its teaching overlaps it in many respects. Without having seen one of these institutions it is almost impossible to realise their vast extent, the beauty of their construction, the completeness of their arrangements, and the luxury with which they are fitted. The provision of polytechnic schools in Germany is, however, in excess of the present requirements of the people. This arises from the fact, that when these institutions were first established, Germany was divided into several states, each of which tried to excel the other in the magnificence of its schools, and to attract to itself the largest number of students. These schools are known in Germany by the name of Technical High Schools, the word High School being synonymous with University. The annual cost of the main-

tenance of these establishments is about a quarter of a million of money, and the erection and equipment of them has cost not less than three millions sterling.

It says much for the desire for higher education in Bavaria, that, although the university and the polytechnic school exist within a few yards of each other in the same city, and although the chemical laboratories of the university were, till recently, the largest in Europe, the laboratory of the polytechnic was, at the time of my visit, fully occupied, and the question of extending it was under consideration. The building with its collections has cost little less than 200,000*l.*, and the annual expenditure on maintenance is 20,000*l.* The institution consists of six special schools—the general school, intended principally for the training of teachers, the civil engineering school, the architectural school, the mechanical engineering school, the chemical school, and the agricultural school. The leaving certificate of the *Real-Gymnasium* is accepted as a qualifying certificate for admission to the polytechnic; the students obtaining a similar certificate from the Technical College or *Industrie Schule*, which I have described, and which they leave at the age of eighteen, are also admissible to the polytechnic. Of course, the students coming from the Technical College or *Industrie Schule* bring with them to their studies at the polytechnic a different kind of prepara-

tion from that of the students of the modern side of the *Gymnasium*. As represented in the diagram, the education given in the former is intended to be complete and well rounded off, fitting the student at once to enter industrial work. The student leaving this school has received less general education, less theoretical teaching, and more practical instruction than the student who enters the polytechnic direct from the *Gymnasium*. It is another moot point whether students who have received this more practical teaching are better or worse adapted to take advantage of the higher instruction given in the polytechnic school, and many educational authorities in Germany are strongly of opinion that a broad basis of general instruction is that which best enables a student to succeed in the higher walks of science; and some go so far as to regret that students from the *Industrie Schule*, who have received from the beginning a different kind of training, are permitted, without further preparation, to continue their studies in the polytechnic schools. It appears that at least sixty per cent. of the students of the *Industrie Schule* pursue their education till the age of twenty-one or twenty-two at the technical high school; and these students, it should be observed, have been three times passed through the sieve of examination, and weeded from their less successful competitors—first, on leaving the elementary school to enter the *Realschule*; secondly, on leaving the *Realschule* to enter the

Industrie Schule; and thirdly, in passing on to the polytechnic.

A special feature of the German technical high school, as well as of the university, is the great subdivision of such subjects as engineering, architecture, and chemistry, each special branch of the subject being placed in the hands of a separate professor. Thus, for example, there are forty-five distinct courses of lectures given in the engineering department of the Munich school, and the number of professors who give these courses is eighteen. There are, in all, 196 different courses of lectures mentioned in the programme, and these are assigned to thirty-six professors and thirty-four teachers besides assistants. This distribution of teaching among professors, each of whom is specially conversant with the details of some portion of the subject, is in striking contrast with the English system, in which the instruction is generally placed under the direction of one professor as head of the department, assisted by two or three lecturers or teachers. A much closer specialisation of study is needed in our own institutes for advanced technical instruction, if they are to fulfil the functions of a German Polytechnic School.

The most interesting and important section of the Munich Polytechnic is the engineering school. This department consists of numerous rooms for instruction in mechanical drawing, of collections of models, and of laboratories for special practical work. It com-

prises six large rooms, used exclusively for machine drawing, one of which is furnished with 100 tables. The machine workshops contain a compound steam-engine having complete appliances for registering the various degrees of expansion and speed developed. Another laboratory is furnished with a testing machine, working up to 100 tons, for determining the strain and the elasticity of various substances. This laboratory has been largely utilised by manufacturers and others for the testing of different materials, both in Bavaria and throughout Germany. The total number of students in attendance at the Munich polytechnic for the year 1887–8 was 733 in the winter and 701 in the summer session. The attendance previously had at one time been as high as 1,300; the falling off in the number of students, due to the completion of the railway system of Germany and to the general depression of trade, has been less in this polytechnic than in many other institutions of a similar character. The number of students is now again increasing.

The Director's annual Report contains a notice of the various contributions to the advancement of Science and Art, made by the professors and their assistants, outside their ordinary educational work. This notice, given under the heading 'Wissenschaftliche und Kunsterliche Thatigkeit der Professoren, Dozenten und Assistenten,' which is a bare index to the research-work of the teachers, occupies ten

closely printed quarto pages of the Report for 1887–88 of the Munich School. When we consider that similar 'activity' is shown by the professors of other polytechnic schools, and of all the German universities, we get some idea of the encouragement which these institutions afford to the advancement of science.

Of other polytechnic schools, the largest and most recently constructed is the Polytechnic School of Berlin, which was completed in 1884. It is situated at Charlottenburg, a fashionable suburb of the capital, and has been erected and equipped at a cost of about 450,000*l.* This school and the new University of Strasburg are probably the most extensive and the most elaborately fitted educational institutions in Europe. Attached to the Berlin Polytechnic School are sixty-three professors, in addition to several lecturers, demonstrators, and assistant teachers. The academic session lasts from October 1 till the end of July; in Munich, from October 15 to August 15. The fees are low, so that the education is brought within the reach of all classes of society above the poorest; and for the benefit of these the fees are readily remitted, and scholarships are provided. For a single course of one lecture per week, the fee is five shillings for the session, and three shillings for the corresponding exercise class.

Side by side with the polytechnic, or school of applied science, is found in very many of the largest

German cities the industrial art school, or *Kunstgewerbeschule.* The object of this school is to give instruction in art, and in its application to special industries. No similar type of school exists in France. Like all other great educational institutions, the school is generally located in an architecturally beautiful and tastefully decorated building. The temple dedicated to art or science must be no mean structure. Such schools are found in Berlin, in Dresden, in Munich, in Nuremberg, in Vienna, and in other German cities. They contain a large number of special departments, in which the student is taught to draw, to model, to paint, and to design, and to work out his designs in appropriate materials. An important part of the instruction consists of lectures on the history of Art as applied to particular trades.

The Art School of Munich is itself a university of art, divided into numerous sections, in which instruction is given in drawing, in modelling, and design, as well as in their applications to a variety of different industries. The ceramic department of the school is fitted with a furnace, in which the students fire the ware after painting on it, as at Sèvres. The school also contains a room in which the students are engaged in full-sized decorative work, such as a builder or architect might be required to execute. In the textile department the pupils prepare designs on 'point' paper, which are largely used by manufac-

turers. There is also a department for glass-staining, in which designs are prepared and completed.

The school has a most important influence upon trade, and its advantages are fully recognised and appreciated by the merchants and manufacturers who purchase designs prepared by the students, and whose *employés* receive their training there. Such a school, provided with the necessary plant and apparatus for the execution in the material itself—be it glass, porcelain, wood, metal, or some textile fabric—of the design prepared by the artist, affords facilities for experimental art-work which, when successful, may be, and often is, the means of introducing into the country new industries.

The fees are ten shillings the semester for Germans and twenty shillings for foreigners. The annual expenses amount to 4,390*l.*, of which the sum of 223*l.* is received in fees. Bavarian students in needy circumstances pay nothing.

In other German cities there are similar schools. The Industrial Art School of Vienna is a State institution, connected with the Industrial Art Museum. It is maintained at a cost of 4,000*l.* a year. It contains special departments for wood-carving, wood-turning, metal-chasing, ceramic art, furniture designing, designing for textiles, &c. The instruction is essentially practical. In the metal-working class, for instance, the student first makes the drawing of the design; he next makes a model in clay from the drawing; he

then casts the object in bronze, brass, or other metal, chases, and finishes it; and, finally, he makes a drawing of the figure thus completed, and compares this drawing with the original design.

In the school at Berlin the teaching is less practical, in accordance with the educational ideas prevalent in Prussia. The school corresponds more nearly with the Art Training School at South Kensington, on the plan of which it was modelled. A special feature of the Berlin school is the magnificent art library, open to students and to artisans generally.

In France, where art teaching has been so fully developed, there is no institution that exactly corresponds with the German *Kunstgewerbeschule*. The existence of such a school opens up the vexed question of the distinction between industrial art and fine art. In France the difference is scarcely recognised. Students who are training to be trade designers are taught art. Their eyes are saturated with nature, and their hands are taught to represent it. Throughout France, the evening art schools are filled with artisans, who are instructed in the general principles of design, but who are taught to find in natural objects, and particularly in the human figure, their inspiration. Nowhere, perhaps, are the artist and artisan so truly united as in France; and this arises from the fact that the workman is taught to draw, first at the primary school, then at the higher school, and later on in evening classes.

In some of the French art schools, especially in those located in the centres of particular industries, as at Lyons, St. Etienne, Limoges, and Vierzon, drawing is taught with a view to its application to weaving and pottery. What makes the instruction special is that the students are for the most part engaged in the industry, and are familiarised, through the aid of local museums, with the best specimens of art work, and learn the history of Art in relation to their trades. Nearly all the French teachers emphatically protest against the idea that there are two sorts of art. The teaching of art, they say, must be liberalised. Art must be taught as art, and not with a view to its application to silk-weaving, calico-printing, china-painting, paper-staining, or any other trade. In the German school, the applicability of the design to the material is a matter of instruction and not of inspiration, and the teaching of drawing is specialised accordingly.

There are in Bavaria other educational institutions, fulfilling various purposes, such as training colleges for teachers, music and dramatic colleges, needlework schools, military and veterinary schools; but the description of these is outside the purpose of the present chapter.

The cost of education in Bavaria is considerable. No expense is spared to render these several schools thoroughly efficient, both as regards the number and character of the teachers and the excellence of

the appointments and fittings. According to the returns most recently published, the annual charge of these educational establishments on the State is as follows :—

		£
Elementary Schools		238,421
Evening and Sunday Schools		26,570
Real Schools		76,620
Industry Schools		11,125
Real Gymnasia		9,040
Classical Gymnasia		93,324
Universities		78,612
Polytechnics		20,164
Technical Art Schools		8,367
Training Colleges		49,870
Girls' Higher Schools	(about)	15,000
Other Educational Establishments	(about)	100,000
		£727,113

This annual expense is borne by the State, in addition to sums contributed from local funds and from ancient endowments, in a country having a population of less than five and a half millions.

In the preceding pages I have desired to draw attention to the system of school organisation in Bavaria, and principally in reference to industrial education. To do so, it has been necessary to refer to the elementary schools and to the universities—at the ends of the educational ladder, and also to the cost of the maintenance of these institutions. Of the curricula, and of the methods of instruction, I have said very little. The former can be obtained from the programmes annually published, and to enter fully into a description of the methods of teaching the

several subjects comprised in the curricula would occupy considerable time and space. An acquaintance with the German system shows that, notwithstanding many undeniable objections, there is much to be said in favour of State control of secondary and higher education. The rivalry among different schools, and the competition for pupils, involving various forms of expensive advertisement, which characterise the free system of England, do not exist in Germany. The Government takes care that each district is provided with the schools adapted to its wants, and the curricula of these schools are determined by the requirements of the locality. The gradation and co-ordination of schools under such a system is far more complete than is at present possible in England. The lowness of the fees, too, and the more general appreciation of the advantages of education, together with the desire of parents, even in humble circumstances, to secure for their sons immunity from the three years' military service, are among the causes which increase the attendance at the higher schools, and raise the standard of education among all classes of the German people. As regards the teachers, their average earnings may be lower in Germany than in England, but their salary is secured to them, and is independent of the number of pupils in attendance at their schools. They are also entitled, as Government servants, to a pension, and their social position is good. In the zigzag and indirect way in which progress is made in this

country, we are, I believe, approaching to a condition in which the State will exert more influence over secondary and higher education, and, provided only that local requirements are sufficiently carefully considered, the change will be an advantage to our schools, and a gain to our teachers.

If the preceding sketch of a 'school system' has shown us anything, it is this: that in Bavaria secondary education is carefully organised, and that adequate provision is made for all the various educational requirements of the people.

CHAPTER VII.

THE FINSBURY TECHNICAL COLLEGE—INAUGURAL ADDRESS.[1]

IN laying the foundation-stone of this college some twenty-one months ago, his Royal Highness the Duke of Albany described it as 'the first Technical College ever erected in London,' and the remarks I have to make this evening, at the opening of the college, will be partly directed to the justification of the epithet employed by his Royal Highness. Considerable misapprehension still exists in the public mind as to the aims and possibilities of technical education. Some persons look to technical education to remedy all our industrial shortcomings; others fail to see its advantages or its necessity. Some, again, regard all science-teaching as technical; others restrict the word 'technical' to the teaching of an actual trade. The majority of people take a very narrow view of the extension of this term; and very few seem to understand the different kinds of training to

[1] This address was delivered at the opening of the College on February 19, 1883.

which it is properly applicable. I often wonder what kind of idea those persons can have formed on this subject who speak, and even write, of teaching 'technical education,' and of placing it in a schoo curriculum, side by side with history and geography, as if it were some newly discovered branch of knowledge.

But the main purpose of my address this evening is to point out the objects which the founders of this college have had in view, to indicate the character of the instruction to be given in this college, and to snow its position in the general scheme of technical education, as elaborated by the Council of the City and Guilds of London Institute.

In nearly all discussions about technical education it is customary, I find, to commence with a definition; and I am unwilling to deviate from so general an observance. But as every definition is a statement about words, and everything technical relates to things, I would recommend those who want to know what is here understood by technical education to visit the Finsbury College when the students are at work, and to apply the word 'technical' to the education they are there receiving. The definitions that have been given of this term by various writers are almost as numerous as the occupations to which it refers, and consequently any definition, to pass unchallenged, ought to be expressed in as general terms as possible. Without attempting, therefore,

any exact explanation of the term, I propose to call that education, training, or instruction 'technical' which has a direct reference to the career of the person who receives it. Considered thus generally, there is nothing new in this kind of education, except the name, and the careers and occupations which, owing to the recent developments of science, have come into existence. It is because the system of education to which for centuries we have been attached is no longer the best preparation for the several employments in which a large and increasing proportion of the population, previously wholly uneducated, is now occupied, and not because no relation hitherto existed between the boy's training and the man's career, that the term technical education has come into use; and the term is difficult of precise definition, because it applies to other kinds of training than to those to which it is generally assigned. Thus, the special education of the soldier, the surgeon, the lawyer, or the schoolmaster, is as technical as that which the City and Guilds of London Institute aims at providing for the engineer, the weaver, the manufacturing chemist, or the cabinet-maker.

If I were asked to say what has given rise to the necessity of technical education in its narrower signification, as commonly understood, I should answer, the invention of the steam-engine. It is to the steam-engine, primarily, that we owe production on

a large scale; and to production on a large scale we owe the breaking up of the old apprenticeship system, and the necessity of some other kind of preparatory training. The result of the introduction of machinery, and of its substitution for hand labour, has been a keen international competition for trade, which, among its other effects, has reduced the margin of profits, and has consequently led to the necessary utilisation of so-called waste products, and has stimulated scientific research as applied to the processes of manufacture. We might, if time served, trace back to the steam-engine many of the changes which, during the last thirty years, have been creeping over our educational system—changes which mark only the beginning of a revolution that promises to sweep away much that is time-honoured in our methods of instruction. The wave that is pushing forward technical education will not subside until our primary and middle schools, our higher secondary schools, as well as our ancient universities, shall have felt its influence.

One of the determining causes which have guided the council of this institute in the organisation of their scheme of technical education has been the desire to supplement, where it seemed deficient, without duplicating the existing educational machinery. They have consequently regarded primary instruction, which is the basis of all education, and is now happily cared for by the State, as outside their sphere

of action;[1] and they have left to local efforts, supplemented by such aid as may be elsewhere obtained, the provision of higher elementary or intermediate schools, the want of which is now generally experienced. Acting on the same principle, they have endeavoured to utilise the science teaching, so extensively encouraged by the Science and Art Department, by supplementing it with special instruction in technology; and this department of their work, which is represented by their system of technological examinations, has already taken root in all the large manufacturing centres of the country, and has been the means, in many cases, of establishing well-organised and properly equipped technical schools.[2]

[1] As the School Board of London was prevented by the conditions of the Code from making any provision for manual instruction in the schools under its control, the Council of the Institute were induced, by the offer of a grant for that purpose from the Drapers' Company, to give the Board temporary help by equipping six centres in London for workshop teaching, and by paying the instructors for one year (see pp. 138–40).

[2] The progress in this department of the Institute's work has been very marked. The examinations were originally conducted by the Society of Arts, to whose initiation so many movements for the improvement of our trade and commerce have been due. In the year 1879, when the examinations were transferred to the Institute, 202 candidates were examined in 7 subjects in 23 different centres. In the year 1883, the date of the opening of the Finsbury Technical College, 2,397 candidates were examined in 37 subjects in 154 centres; and in 1888 these numbers had increased to 6,166 candidates, 40 subjects, and 240 centres. Several new technical schools have been erected during the past few years, and many of the old mechanics' institutes have been partly rebuilt and entirely reorganised, with the view of providing practical instruction in science, and also in the application of

Without at present attempting to interfere with primary and higher elementary education, the Council of the Institute are endeavouring to establish, in the metropolis, schools and colleges of different grades, as well as evening classes for the technical instruction of persons who are engaged, or intend to engage, in purely productive, as distinguished from commercial, industry. In the development of this scheme, every improvement that is made in the elementary and intermediate education of the country facilitates their work. Possible improvements are not difficult to suggest. Our elementary instruction would certainly be improved if drawing were taught, and better taught, to all the children of the primary schools; and if, also, in accordance with the suggestions of the Commissioners on Technical Instruction, handicraft work were made a part of the ordinary curriculum of some of these schools. In two of the Board schools of Manchester, the experiment of training children in the use of wood-working tools is now being tried; and should this experiment prove successful, there is very little doubt that the example set by Manchester will be followed by other towns. The difficulty of the want of time, to which reference is so frequently made, might be got over by lengthening the school

science to special industries. During the session 1887-88 the number of artisan students in attendance at the registered classes of the Institute was 10,404.

hours, which are shorter in England than in any other country which the Commissioners have visited.

The question of higher elementary or intermediate education is daily attracting more attention. At present no part of our educational system is more defective. The fault of nearly all our middle-class schools is that they give an education of the same kind as that of the higher secondary schools, but of distinctly inferior quality; and that no attempt is made to adapt the curriculum of these schools to the special requirements of the pupils who frequent them. These defects are partly owing to long-standing educational traditions; partly to the powerful influence of the older universities, which almost entirely control school education of every grade above the primary; and partly to the fact that there does not, at present, exist any recognised Technical Institution, having the educational rank and position of the universities, which could make its influence felt over all schools leading up to it, and into which pupils might be drafted by successive stages from these schools. Indeed, the deficiencies of these middle schools seem likely, for some time to come, to somewhat lower the character of the education, which might be given to better prepared pupils at this college.

At present the universities are the only representatives of higher training, and there is no other avenue leading to them except a literary education. Of the need of schools, giving instruction superior to that of

the elementary schools, and preparing students for institutions like the Finsbury Technical College, there can be no question; but in order that this want may be supplied, it is necessary, in the first place, that the character of the teaching to be given in such schools should be settled, and in this matter nothing definite seems as yet to have been determined. Numbers of existing schools, by a rearrangement of their curriculum of studies, might be converted into the missing links between primary schools and technical colleges, providing to the children of artisans the training which would be the best preparation for their subsequent work. This question, however, is full of difficulties, and its further consideration would take me far beyond the limits of my present purpose. My only reason for referring to it is to indicate the kind of connection that should exist among the several grades of schools forming the educational ladder, from the elementary to the highest technical school, and in order to show what place the Finsbury College occupies in this graduated series.

The Finsbury College consists really of two schools—a day school and an evening school. The day school gives that preparatory training which will fit students for practical work in the factory or engineer's shop; and the evening school is intended to help those who are already engaged in various industries to understand the scientific principles underlying the processes they see exemplified in their

daily work. This day school is a technical school of the third grade. It will receive its pupils from middle-class or intermediate schools; and whilst the majority of the students will complete their education within its walls, some will proceed, by means of scholarships or otherwise, to the Technical University or Central Institution, now in course of erection at South Kensington.[1]

The programme of this school, which has recently been published, states that the Technical College, Finsbury, has for its objects the education of—

(1) Persons of either sex who wish to receive a scientific and practical preparatory training for intermediate posts in industrial works.

(2) Apprentices, journeymen, and foremen, who are engaged during the daytime, and who desire to receive supplementary instruction in the art practice, and in the theory and principles of science connected with the industry in which they are engaged.

(3) Pupils from middle-class and other schools, who are preparing for the higher scientific and technical courses of instruction, to be pursued at the Central Institution.

As such, the day department of this college may

[1] Such scholarships have already been established. The Mitchell Trustees have founded two, and the Clothworkers' Company have [illegible] who have received their early education in a public elementary school.

claim to represent a new grade of school in our educational system. It is not a technical high school like the polytechnics of Germany and Switzerland, in which professional engineers, manufacturing chemists, architects, and technical teachers are trained, and in which a wider and more exact knowledge of theoretical science is imparted to the students, and demanded from them as a condition of entrance. On the other hand, it is not a school in which any actual trade will be taught, except it be some art industry, in which taste and skill, and knowledge of the capability of the material in which the work is to be executed are the main conditions of success. Nor is it a school like the apprenticeship schools of France, which, notwithstanding much that has been said and written in their favour, are not generally regarded by experts on either side of the Channel as the best means of training workmen or foremen, and are certainly not in accord with the conditions of industrial success of this country. It is, however, a school in which workmen, desiring to become foremen, will have the opportunity of supplementing the training of the shop, by receiving practical instruction in the principles of science in their application to the industry in which they are engaged ; and the evening department of the college has been especially organised with a view to their requirements. But workmen will not learn, in this school, that rapidity of execution which can only be acquired in the factory or workshop, where, under

the severe strain of competition, saleable goods are manufactured.[1]

The day students will enter the college between the ages of fourteen and seventeen. They should have previously received a sound English education, and have acquired an elementary knowledge of mathematics, physics, and chemistry, as well as some familiarity with the French and German languages.

[1] Reference has already been made (p. 35) to the conditions under which apprenticeship schools may become the means of advancing any particular industry. Such schools cannot permanently take the place of apprenticeship. They are useful in the training of foremen, but only under exceptional conditions do they serve for the creation of workmen. Dr. Bouvy, in a little work entitled *Enseignement Professionnel et l'Apprentissage*, published in Liege, 1888, has well pointed out the impracticability of attempting generally to substitute school instruction for workshop training. He rightly says, 'In order that such schools may succeed, they must fulfil many conditions which it is difficult to combine;' and he refers among other things to the constant changes which are made in the machinery used in actual production, which cannot be effected, except at a prohibitive cost, in any school. Having regard, too, to the number of schools needed, the expenditure needed for the proper training of the workmen of different trades would be enormous. Abroad, these schools, when successful, are largely supported and administered by members of the respective trades, and receive only a subvention from the State or the municipality. In many cases they are supported partly by the trade, and partly by the State, the province, and the city. The tailors' school at Brussels receives a subsidy of 120*l.* a year from the city. Its annual cost of maintenance is 450*l.*, and it has 30 pupils. The course of study lasts four years. This school is a good example of an apprenticeship school for the teaching of a trade in the practice of which little or no machinery is required. The cost of the erection of the well-known *École Diderot* at Paris for the training of mechanics was 10,000*l.*; its annual budget is 6,000*l.*, and the number of pupils is 330, of whom about 80 pass through the three years' course. Many of the trade schools found on the Continent are, in reality, schools for foremen.

With the view of indicating the kind of education that should be given in schools of a lower grade from which students will be received into the college, it is the intention of the Council that the pupils shall be required, after a time, to pass an entrance examination in these subjects. The courses of instruction are arranged to occupy at least two years. On entering, the student will state whether he wishes to be trained as a mechanical engineer or an electrical engineer; whether he wishes to be educated with the view to some branch of chemical industry, or of the building trade; or, finally, whether he desires to study applied art. In any of these cases except the last he will find mapped out for him a complete course of study, occupying about seven hours a day, and involving laboratory instruction, tutorial work and attendance at lectures, exercises in mathematics, mechanical and freehand drawing, instruction in the workshops, and lessons in French and German. The hours of attendance are longer than in most English schools; but as a great part of the student's time is occupied in practical work, some of which exercises the hand and eye rather than the brain, the mental fatigue consequent on longer hours is not likely to be excessive. On the contrary, the alternation from brain work to physical work, which is a part of the system of education adopted at this college, is calculated to lighten the burden of theoretical instruction, whilst it affords training to bodily organs, which in

other systems of education are not at present sufficiently exercised.

The programme recently published shows the courses of instruction which have been arranged for students in each department. The separate curricula comprise instruction in subjects having a direct bearing on the industry which the student proposes to follow. Whilst the utilitarian side of education has been kept steadily in view, no subject having been included in these curricula a knowledge, and an ever-increasing knowledge, of which the student will not find it desirable to possess, the methods of instruction adopted are such as will, at the same time, stimulate and develop the reasoning faculties of the pupil. The instruction will be technical in so far as it refers to the career of the student; but it must not be supposed that because it is in this sense technical, and consequently strictly useful, it is therefore less disciplinary. One of the yet unsolved problems of education is to discover subjects of instruction which a schoolboy, in after-life, shall not cast aside as unprofitable, either for the purposes of his daily work or recreation, and the teaching of which shall have the same disciplinary effect as that of other subjects, which for so many centuries have been the sole instruments of education. In this college, an attempt will be made to partially solve this problem by teaching science with this double object; and we may be certain that whenever methods of science-teaching shall have been elaborated

and generally approved, which shall yield the same mental exercise as classical studies have hitherto afforded, the present system of school instruction will everywhere undergo an entire change.

There are several features in the curriculum for day students of the Finsbury Technical College which mark it out as a new departure in educational work, and distinguish it from other schools hitherto established in this country. As an educational institution, it is intermediate between what we are accustomed to regard as a college and a school. The instruction afforded is that of a college; the discipline, that of a school. A definite course of instruction is laid down for each pupil; and this course, if properly pursued, is intended to give him a wide and cultivated acquaintance with science and art in its relation to the industry he is to follow. No narrow view has been taken of the educational requirements of the student; and in this respect the college curriculum is a protest against the opinions of those who see a practical antagonism between mental culture and technical training. The late Professor De Morgan used to say that every subject of study may be made the element of a liberal education if properly taught; and in this college will be tried the experiment of developing the faculties of the student by the study of subjects having a direct bearing on his future career. One great advantage of this kind of instruc-

tion is that the pupils attending the courses laid down for them will be educated, in the true sense of the word, at the same time as they are undergoing a special training for the real business of their life. Those who have a correct appreciation of the scope and aim of technical education rightly speak of it as the borderland between the school and the factory. It is such. Adopting the methods of the one, it familiarises the student with the processes of the other. It enables him imperceptibly to pass from books to work, and to apply the theories of the former to the practical details of the latter.

Although the pupils of each department of the college receive instruction in the same subjects, the amount and character of the instruction they receive depend, so far as these are able to be ascertained, upon the future occupations of the pupils. Thus, whilst all the students learn mathematics, mechanics, physics, chemistry, and mechanical drawing, each student will be chiefly occupied with the laboratory work connected with the department which he enters; and his lessons in mechanical drawing will be specialised with a view to the trade for which he is being trained. If, after a time, a student shows more aptitude for chemical than for physical studies, or *vice versâ*; or if circumstances induce the parent to think that there is a better opening for his son as an industrial chemist than as a mechanical or electrical engineer, the student will be able easily to

pass from one department of the college to another, and his previous studies will be almost equally valuable to him in the new department which he enters.

Importance is attached to the fact that instruction in French and German is obligatory on all students who are not already conversant with these languages. These lessons will constitute the only literary training the student will receive in the college, and as such they are valuable; but the chief importance of the instruction lies in the power it is expected will be given to students of being able to ascertain, through the trade journals of different countries, the progress which is being made in the industries in which they are severally interested. The foreman or manager who keeps his eyes open to what is being done in his own country, and who can avail himself of the published accounts of other nations, who can communicate freely with foreigners, and can render a fortnight's holiday abroad profitable as well as pleasurable, will have undoubted advantages over his competitors in the same trade, and the benefit which he personally will derive from his wider knowledge and experience will be of service not only to himself and to his employer, but also to others engaged in the same industry.

Another feature in the school curriculum must be noticed. In all departments, except that of chemistry, where students work from ten to twelve hours per

week in the laboratory, every pupil is required to spend a certain amount of time in the college workshops, in gaining some acquaintance with the manipulation of wood and iron, and with the nature of the tools employed in working these substances. Although the workshop is thus introduced into the school, no attempt will be made in it to train expert workmen. In this country it is now an almost recognised fact that the efficient workman can only be trained in the workshop of life; but it is expected that students, profiting by this course of instruction, will gain some serviceable knowledge of the qualities and capabilities of the commonest materials, of the use of ordinary tools, and of such machines as are found in every workshop, as well as a dexterity of hand and a power of self-help, which cannot fail to be of value to them in whatever occupation they may afterwards be engaged. As time goes on and pupils come to the college better prepared to use their hands this special instruction may become less necessary; but at present it is indispensable; and it is expected that this instruction will shorten somewhat the period of the student's apprenticeship or preliminary workshop training by enabling him the sooner to become useful to his employer, and to gain for himself the full benefit of his new and more extended experience.

The evening classes, as the programme informs us, are intended for those who are already engaged

in some industrial work. Unlike the day school, which represents a new type of educational institution in this country, the success of the evening department of the Finsbury College may be considered as already assured. During the three years in which instruction has been given in the class-rooms rented from the Cowper Street Schools nearly 2,000 students have received instruction in technical science, and there is already reason to apprehend that the new building is too small for the anticipated attendance.[1] A special feature of the evening instruction to be given at the Finsbury College are the definite courses of instruction which have been progressively arranged to occupy the students during four or five evenings in the week for a period of two or three years. It is possible that some time may elapse before students will be made to appreciate the importance of methodic study in connection with their special work. Where the students are almost all adults it is difficult to induce them to attend any other classes than those in which the instruction consists of what may be called 'straight tips' and nothing more, having a direct reference to the details of their daily work. Mere information of this kind, not involving any scientific training, does not constitute education, and is not likely to prove of any real service to the student in enabling him to deal with

[1] [illegible]

unexpected and exceptional cases of difficulty which are certain to arise and impede his progress.

Workmen, generally, make a great mistake in taking a very narrow view of their own educational requirements. Instances of this are continually coming under my notice. It is difficult, for example, to make them understand that a knowledge of intimately associated and cognate branches of their trade is likely to prove serviceable to them—that in order to become efficient foremen it is necessary that they should possess an intelligent and comprehensive acquaintance with the entire area of the work in which they are engaged. It is partly to correct the cramping influence of the extreme division of labour that technical instruction has become necessary. Speaking from my own experience, I should say that workmen, generally, care to learn in the school very little more than they might learn in the shop: they only want to learn it more quickly. The desire of workmen to learn those parts only of a subject which seem to them to be intimately connected with their special occupation reminds me of a fact told me by a medical friend that among his students of anatomy was one who expressed his decided unwillingness to dissect the abdominal cavity, because, as a surgeon, he intended to devote himself exclusively to diseases of the eye. This narrow view of the scope and objects of technical education needs to be steadily and persistently discouraged, and it is one of the objects of

this college to bring home to the workman the advantages of a wider and more comprehensive system of instruction.

A similar difficulty is experienced in inducing adult artisan students to attach sufficient value to a knowledge of the elementary principles of the sciences bearing upon their industry. This is due partly to the method of science-teaching commonly adopted, which does not distinguish between the requirements of school children and of adult workmen,[1] and partly to the fact that such students are too impatient to see the immediate applicability, at each successive stage, of the knowledge they are gaining to their particular work. It is possible that the fundamental principles of science are not always presented to the artisan-student in as attractive a form as they might be, and that he is not made to see at a sufficiently early stage the connection between the instruction he is receiving and the occupation in which he is engaged; but of the value and the importance of this elementary knowledge as preliminary to, and as an essential part of, technical instruction, we must take care never to lose sight.

These and other difficulties will doubtless be found to gradually disappear in the training of young apprentices, who will constitute the workmen of the

[1] The new alternative syllabus in Chemistry ... [illegible]

future, and whom, in the interests of trade, quite apart from the material advantages which they themselves may derive from such instruction, it is most desirable to carefully educate. In Belgium, and in some parts of Germany, where technical teaching is better systematised than in this country, the class-rooms, in the evening, are filled with young students who attend five or six nights a week, and follow the several courses of instruction in the order in which they are recommended to them; and, in the hope of being able to introduce a somewhat similar system into this college, courses of instruction have been arranged adapted to the requirements of apprentices engaged in various industries, but affording at the same time an education in the true sense of the word. These curricula have been drawn up with special reference to the educational wants of the mechanic, the electrician, the metal-plate worker, the cabinet-maker, the carpenter, the bricklayer, the plumber, &c., and are intended to supplement, without interfering with, his workshop training. Although in this college no slavish imitation has been attempted of foreign methods of instruction, I must own that in the suggestions I have been able to make to the Council of this Institute for the organisation of these evening classes, I have been greatly assisted by the insight I have gained into the foreign system of evening instruction, which, as regards its well-ordered and progressive character, as well as its applicability to

the trades of the pupils, compares favourably with the desultory kind of teaching afforded in many of our science classes, where the student too often jumps from the elements of one science to the elements of another, without any consideration of order or of method, or of the necessity of continuity in his studies.[1]

With the view of encouraging young artisans to pursue their studies *pari passu* with their apprenticeship, the Council have arranged to admit this class of students to the benefits of the college at merely nominal fees; and it is hoped that this concession will induce London employers to follow the example of many of their foreign competitors—to pay the fees of the most promising of their apprentices, to remit to them half an hour of their day's work, and to show an interest in their progress, by insisting on their regular and punctual attendance at their several classes.

And now a word or two as to the methods of

[1] In Belgium the evening instruction is given in institutions known as *Écoles Industrielles*. The course lasts three years, and is gratuitous. It consists of two parts, a general and a special course. The general instruction corresponds with that given in the German continuation schools, and consists of mathematics, chemistry, mechanics, physics, industrial economy, and drawing; the special instruction is adapted to the trade of each locality. The direction of the schools is in the hands of local authorities. The cost of these evening schools for the year 1884 was 22,650*l.*, towards which the State contributed about 8,000*l.* It is thought by some educational authorities in Belgium that the instruction in many of these schools is too general, and not sufficiently adapted to the requirements of the workpeople employed in different trades.

instruction to be adopted in this college. In the ordinary teaching of pure science, the preliminary stages of instruction are such as afford, or are intended to afford, the best basis on which the superstructure of higher knowledge can afterwards be raised; and where the pupil has a long course of study before him, to which he can devote himself before being required to apply his knowledge to any special art or industry, no better method of instruction can be devised. But the case is different where the pupil's period of study is necessarily limited, and is not long enough to enable him to attain to that higher knowledge which would justify the time spent in preparation for it. Indeed, in this respect the practical educator may take a lesson from the builder who adapts his foundations to the superstructure to be raised upon them. This question of time is an important factor in the consideration of all schemes of technical instruction, necessitating the early specification of the student's work. For we may take it for granted that the pupil requires not only a knowledge of the principles of science, and of the details of practical work, but the ability to apply the one to the other; and for this reason it is essential that theory and practice should be combined in his instruction, and that both should have reference to his particular work.

In this college, all the subjects of instruction will be taught, as far as possible, with reference to the

careers or occupations of the students; that is to say the teacher will keep steadily before him the purposes to which the student will apply his knowledge in the instruction which he gives him. Indeed, the technical teacher ought to be so constituted as to be able to keep one eye on the general principles of science, and the other upon the industry which his pupil intends to follow. Instruction of this kind must overlap ordinary science-teaching and the teaching of a trade, and must yet be distinct from either. Between the ordinary or scholastic teaching of the elements of physics, and the instruction, for example, that might be given to a novice in the manipulation of a telegraphic instrument, there is a wide difference; and it is within this difference that a technical teacher is called upon to do his work. So, too, between the teaching of Euclidian geometry and the rules that would be given to an apprentice for the construction of a particular kind of joint, or the cutting out of a sheet of metal to a given pattern, lies the borderland for technical instruction in the application of geometry to joinery and to metal-plate work.

Speaking generally, the method of teaching science in this college will be based on the well known educational principle that all teaching should proceed from the concrete to the abstract, from the known to the unknown. The student will be brought into contact, first of all, with the actual working machine, and he will then proceed to analyse it into its

different elementary parts, and to deduce the laws of their action. In this way the principles of science will be derived from the mechanical contrivances exemplifying them, just as the laws of growth and decay are inferred by the student of biology from the observations of living animals and plants. This method of science teaching has been tersely described by Professor Ayrton as the analytical, as distinguished from the synthetical method; and it is satisfactory to know that in this college it will receive a fair trial. To the adult student the advantage of this system of instruction must be plainly manifest; for he, being already familiar with the general character of the machinery he uses, will arrive at a knowledge of the abstract principles of science by a natural and easy method of enquiry into the causes that explain the processes he sees; and, apart altogether from the material advantages he may derive from this higher knowledge, he will be enabled to reach the state of happiness ascribed by Virgil to the similarly educated agriculturist,

'—— qui potuit rerum cognoscere causas.'

It is scarcely necessary to add that the teaching in this school will be essentially practical; that more will be done in the laboratories, in the drawing rooms and workshops, than in the lecture-theatres. Indeed, it may be rather said that the lectures will form a commentary on the practical work than that the

practical wo.k will serve only to illustrate the lectures.

It must be remembered, in considering this difference of method, that the main purpose of the teaching to be given in this institution is not to make scientific men, nor to train scientists as the Americans call them, but to educate technikers, as the Germans say,—to explain to those preparing for industrial work, or already engaged in it, the principles that have a direct bearing upon their occupation, so that they may be enabled to think back from the processes they see to the causes underlying them, and thus substitute scientific method for mere rule of thumb. It is almost superfluous to remark that instruction of this kind can be given by those only who possess a wide and deep knowledge of their subject, and a full and accurate acquaintance with the practical and commercial details of the industry or trade to which their teaching refers. Indeed, it is now generally recognised that technical teachers must be familiar with the processes of the factory or workshop. Teachers of this kind the President of the British Association must have had in view when in his opening address at Southampton, contrasting them with the ardent students of nature, the 'High Priests of Science,' he said :—'It is not to them that we must look for our excellence and progress in practical science, nor must we look for it to the rule of thumb practitioner who is guided by what comes nearer to instinct. It is to the man of science, who gives

attention to practical questions, and to the practitioner who devotes part of his time to the prosecution of strictly scientific investigations, that we owe the rapid progress of the present day.' Such men, of whom the writer himself[1] is so illustrious an example, are difficult to find; and yet the progress of technical education in this country depends upon their supply. The teacher who is to inspire confidence in his artisan students must address them in the language they understand, and must show that he is not beyond appreciating practical difficulties which occur to them in their daily work. Dr. Siemens further tells us that 'theory and practice are so interdependent that an intimate union between them is a matter of absolute necessity for our future progress;' and certainly none are more alive to the truth of this proposition, as regards educational progress, than artisan students, for it is to them a constant source of regret that they are unable to see the relation of scientific truths, as they are generally imparted to them, to the work in which they are engaged; and in this complaint, which is so often heard, is found the protest of workmen against the divorce of practice from theory in the instruction which they frequently receive. With the view of indicating the requisite qualifications of the technical teacher, the Council of this Institute have inserted in their Programme of Technological Examinations a paragraph stating that persons having a practical

[1] The late Sir William Siemens.

acquaintance with their trade, acquired in the factory or workshop, and possessing at the same time such knowledge of pure science as enables them to teach under the Science and Art Department, will be registered as teachers by the Institute.

Of the four departments into which the college is divided, that of electrical engineering promises, for some time at least, to be the most attractive to students. The applications of electricity to telegraphy, telephony, illumination, machinery, and locomotion are among the most recent of the practical developments of science, and seem to afford a glimpse, if nothing more, of the wider field of invention which is yet to be explored. The appetite for wonders grows with what it feeds upon; and never before perhaps was the world more willing to believe in the possibilities of science than now. This universal credence almost constitutes a new Faith. The numerous discoveries fetched within the last few years from the seemingly boundless world of physical science, verify and give a special significance to Cicero's words:—

> 'Omnibus fere in rebus, et maxime in physicis, quid non sit citius quam quid sit, dixerim.'

Although electricity may be regarded, just at present, as the most popular of the sciences, the discoveries which have recently been made in other branches of knowledge are scarcely less important. The skill and the inventive power of the mechanician

have been called into requisition with every advance in physics and in chemistry. Indeed, it is only when the inventions of physicists and chemists are capable of being adapted to machinery that these inventions can be said to be practically serviceable. The great discoveries which have recently been made in chemical science, in the application of which to industrial purposes the Germans and the Swiss have left us so far in the rear, are among the causes that have given rise to the demand in this country for the technical instruction which the City and Guilds of London are engaged in providing. It may reasonably be supposed that many of the students of this college will entertain the laudable ambition to have their names enrolled among those who have pushed discovery one step further, and have added something to the sum-total of human knowledge; and it may be encouraging to these students to be told that they will here receive a preparatory training that should help to place the power of discovery within their reach. For discovery in science, like design in art, does not depend entirely upon, although it is greatly aided by, inspiration and genius. Any one who is carefully trained in the methods of research, who is shown the processes by which the system of organised knowledge, known as science, has been gradually built up, may reasonably hope to unravel fresh secrets of nature, and to add something to our knowledge of what is or may be. Except perhaps in the region of

chemistry, it is not the masters of acquired knowledge, the professors of abstract science, but rather those who have made Science minister to Art, practising first and then calling theory to their aid, – who, as discoverers, have exerted most influence upon the material progress of the world, and have chiefly assisted in the development of its trade and commerce.

There is one department of the college to which as yet I have made little or no reference: it is the department of Applied Art. This department has been organised partly to meet the wishes of the numerous cabinet-makers of the district who petitioned the Institute that courses of study should be arranged adapted to this industry, partly because it was thought advisable to affiliate to the college the City School of Art, originally established as a school of design for the Spitalfields weavers, and partly because no technical college is complete which does not provide its students with art instruction. In assisting the cabinet-makers of the neighbourhood, this school will doubtless prove of great benefit in the development of this important industry. For although cabinet-making is one of the art industries in which the English may be said to hold their own against foreign competition, it is nevertheless a fact, which may not be generally known, that foreign designers and foreign workmen have been, and are, frequently employed on some of the best work executed by English firms.

As an adjunct to the science classes of the college, the art instruction to be given to all the regular students is of the utmost importance. A glance at the time-table given in the Programme will show that every day student must devote from two to four hours a week to lessons in drawing. There can be no doubt that the artisan population of this country are still lamentably deficient in elementary artistic skill, and until drawing is made one of the essential requisites of education, and is regarded in all our elementary schools as of equal importance with reading, writing, and arithmetic, the artisans of this country will be, in many respects, inferior to those of France and Germany. The Institute's examiners in technology are almost unanimous in their complaint of the inability of the candidates to illustrate their answers by intelligent sketches. In this college all students will be taught drawing; and it is expected that the lessons they will receive in this department will not only give them that power of drawing from natural objects so essential to workmen of every grade, but will also help to elevate their taste, to develop their imagination, and to cultivate in them that love of the Beautiful, which may not be found in the search for the Useful and the True in the other departments of the college.

But it is especially as a school for the training of industrial artists and trade designers that this department of the college will supply a long-standing

want in the east end of London. This school is not intended to train young men and women to paint pictures, which if favourably received may gain a place on the top row of the exhibits of the Royal Academy: it is essentially a school of applied art—a school in which persons of either sex will be taught to produce designs adapted to various materials, and whenever it is possible to execute them in such materials. The pupil who is studying as a glass-stainer will receive different instruction from the wood-carver or metal-chaser. Much of the preliminary teaching must necessarily be common to all the pupils. The animal and vegetable creation must be studied, in order that they may yield material for rearrangement and reproduction; but here, as in other departments of the college, the instruction will have as close a reference as possible to the career of the pupil. It is the desire of the Council to considerably extend this department, so that the cabinet-maker, the house decorator, the metal-chaser, the silversmith and jeweller, the glass-stainer, the stone-mason, and the lace-designer may have the opportunity, in this college, of studying art in its application to their several trades.[1]

[1] As regards the teaching of [illegible] art, we in this country may be said to be [illegible] groping our way, [illegible] definite conclusions. [illegible]

Schools of this kind are not numerous in England; but abroad, especially in Germany, they abound. In Munich, Nuremberg, Dresden, Berlin, Vienna, and elsewhere, the *Kunstgewerbeschule*, or Industrial Art school, is lodged in a palatial building, decorated frequently by the students themselves, and divided into different departments, in which the pupils, male and female, after going through the general course of instruction, are taught to work in different materials,

the decorative artist, and the industrial artist; also the particular stage in the art training of a student at which his work should be specialised with a view (1) to the trade for which he is to design, (2) the material in which he is to work. In England, hitherto, no special system has been adopted. The principles of design have been taught in some of our art schools, but very often the teacher of the school established to promote a local industry is himself ignorant of the capabilities of the material to which his pupils will have to apply their design, and the mechanical appliances by which the design can be reproduced in the material. Such knowledge, founded on practical experience in the factory, is necessary to the successful trade designer. But the designer must be first of all an artist; and it is in artistic skill, rather than in technical knowledge, that our own designers still fail. In this respect they are improving, as is shown by the fact that industrial designs are not now purchased from Paris to the same extent as previously, but a far greater spread of artistic skill and artistic perception among our working classes is needed.

Many of our art schools are too small and too imperfectly supplied with the necessary appliances for good art teaching. Modelling is too little taught, and drawing and painting from the female figure is too rare. We may take it for granted that the human figure is of all living forms the most suggestive for decorative purposes. It is important, therefore, that artisans should have facilities for drawing from such models. The schools of Paris and of other large cities are crowded at night time with artisan students drawing and painting from the living figure, nude and draped. The Finsbury Technical College was one of the first schools in England in which regular instruction from the nude was afforded to artisans.

to understand the history and technique of their several trades, and to produce in the school itself finished works. Of the influence of these schools on the industries of the several countries I cannot now speak. The matter will be referred to in the Report of the Royal Commissioners. But of the desirability of establishing such a school in this particular neighbourhood I have no doubt whatever; and the Council of this Institute continue to cherish the hope that the wealthy Corporation of this city, at whose suggestion, partly, the City School of Art was transferred to the college, may be induced to place at the disposal of this Institute sufficient funds for the erection of a new wing to the college in which art may be taught in its application to some of the principal industries of London.[1]

In its general features the Finsbury College, with its four departments, may be regarded as a type of other colleges which, it is hoped, in course of time, will be erected in the great manufacturing centres of this kingdom. In the establishment of such colleges it is important that due regard should be paid to the special wants and requirements of each particular district. Uniformity is not to be desired in any kind of education, least of all in technical education. Throughout Europe, the greatest possible diversity is found to exist among the technical schools and colleges. London itself is uniquely situated as re-

[1] This has not yet been accomplished.

gards technical instruction. A large number of different and important trades are carried on in and near to it, which render it advisable, in a college such as this, to adapt the instruction to a few parent industries, and to specialise it according to the requirements of small classes of pupils. In the provinces the trades are generally more localised, and special attention should in all cases be given to the staple industry of the district. Thus, whilst it may be found advisable to create a special school of mechanical engineering, and possibly one for the building trades, in almost every technical college, the other departments should be devoted to instruction in weaving and dyeing operations; to mining and metallurgy, with special reference, in some places, to the manufacture of iron and steel; or to chemistry in its application to the alkali trade, to gas manufacture, brewing, spirit distilling, &c.

Abroad, under different names, several large and flourishing technical institutions exist, which may be compared, to some extent, with the Finsbury College. They will be found in Lille, Rheims, Lyons, Chemnitz, and Mulhouse, which, in the linen, cloth, silk hosiery, and calico-printing trades, are the rivals of Belfast, Bradford, Macclesfield, Leicester, and Manchester.[1] Such schools are to be found in Crefeld, Winterthur, Munich, and in other places. In Italy, where technical instruction, although not as highly

[1] Each of these cities has now its technical school.

developed as in other countries, is well and systematically organised, there exist, under the titles of *Istituti Tecnici*, and of *Scuole Professionali*, sixty-nine schools, some of which have departments of marine engineering, weaving, dyeing, and agriculture, but many of which resemble in their general objects this college.

In order to indicate the relation that should exist between the middle-class schools of the metropolis and this college, the Council of the Institute have agreed to offer annually for competition to the adjoining middle-class school six free studentships, tenable for two years, and one to each of twelve other schools in or near London, including the United Westminster School, the Haberdashers' School, the Mercers' School, the Drapers' Schools, and the schools of other companies; and further, to enable the more promising pupils from these schools, after passing through the Finsbury College, to obtain the highest technical instruction, the Council contemplate the establishment of one or more scholarships at this college, tenable at the Central Institution, and they look to the benevolence of other corporations and individuals to found more.

Passing in review the various schools which, during the last eighteen months, in company with my colleagues, the members of the Royal Commission on Technical Instruction, I have had the opportunity of inspecting, I think I may say that I have not seen

any school abroad, which for the completeness of its arrangements can compare with the electrical department of this college. Indeed, it is only recently that physical laboratories, in which the students themselves are exercised in quantitative experimental work, have been added to the technical schools of the Continent. Within the last few months I have heard that a practical school of electricity, somewhat similar to our own, is to be founded in Paris; and not long ago I read an announcement in the 'Times' that 'in view of the great and growing importance of electric art, lectureships on this subject have already been established at Stuttgart, Aix-la-Chapelle, Karlsruhe, and Hanover; and this winter students will be specially instructed in the same subject in the University of Berlin.' If we can claim precedence over other nations in having established a good practical school for the training of workmen and foremen in electrical engineering, we cannot conceal from ourselves the fact that, notwithstanding the great progress that has been made during the last few years in the erection of technical schools in different parts of the country, we are still considerably behind our Continental neighbours in the matter of technical education.

In France, Germany and Switzerland, technical schools are out of all comparison more numerous than they are in this country, and are more organically connected with the educational system of those

countries. Moreover, they are so graded that pupils can pass from the elementary to the highest technical school, without any break in the continuity of their studies; and they are so diverse in character as to be adapted to the requirements of nearly every different industry or occupation. That the Germans are proud of their educational system there can be no doubt. That they are satisfied with it is not equally clear, for they are constantly endeavouring to improve it; and latterly opinion has set strongly in favour of the introduction of more practical work into school instruction. To their technical schools the Germans rightly ascribe, to a great extent, their industrial success, and they point with pride and satisfaction to the fact that they have weighed their knowledge and their technical training against our material advantages in mineral wealth, and have not found them wanting. But upon these natural advantages it is quite certain we cannot continue exclusively to rely, and I venture to hope that the opening of this new college, which occupies an important place in the Institute's scheme of technical instruction, may help, to some extent, to take away from us the reproach that we are educationally inferior to other nations.

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Salar. My wind, cooling my broth,
Would blow me to an ague, when I thought
What harm a wind too great might do at sea.
I should not see the sandy hour-glass run
But I should think of shallows and of flats,
And see my wealthy Andrew, dock'd in sand,
Vailing her high top lower than her ribs
To kiss her burial. Should I go to church
And see the holy edifice of stone,
And not bethink me straight of dangerous rocks,
Which touching but my gentle vessel's side,
Would scatter all her spices on the stream,
Enrobe the roaring waters with my silks,
And, in a word, but even now worth this,
And now worth nothing? Shall I have the thought
To think on this, and shall I lack the thought
That such a thing bechanc'd would make me sad?
But tell not me: I know Antonio
Is sad to think upon his merchandise.

Ant. Believe me, no: I thank my fortune for it,
My ventures are not in one bottom trusted,
Nor to one place; nor is my whole estate
Upon the fortune of this present year:
Therefore my merchandise makes me not sad.

Salar. Why, then you are in love.

Ant. Fie, fie!

Salar. Not in love neither? Then let us say you are sad,
Because you are not merry; and 'twere as easy
For you to laugh, and leap, and say you are merry,
Because you are not sad. Now, by two-headed Janus,
[illegible]
[illegible]
[illegible]
And other of such vinegar aspect

[illegible]